Vol. 2 No. 6
December 1993

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# Atari Classics

**The Magazine for the Dedicated 8-Bit User**

Special Video Issue!

*In this Issue:*



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**Warm Up Your Soldering Iron!**

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# Super Video 2.1XL

## An Old Project

I began investigating the 800XL's poor video performance in 1986 and never really stopped. How do you condense eight years of continuous research on one topic into one short article? You don't. No way around it, this is going to be one *long* article! However, before we can roll up our sleeves and start shoveling up the video manure Atari dumped on us, I must first render homage to various publishers who participated along the way.

Super Video 1.0 was published by Ed Dell in the February 1987 issue of the now-defunct *ComputerSmyth* magazine. It gave modest improvements in video performance but really only represented a single-pass attempt to solve a problem that went deeper than I realized.

My continued hacking at the problem led to the publication by Joe Waters of Super Video 2.0 in the September 1991 issue of *Current Notes* magazine. That article represented a real breakthrough in my understanding of 800XL video problems and served as the springboard for polishing up the mod and applying the concept to similar upgrades for the 600XL and the 1200XL. I'm grateful to Ed Dell and Joe Waters for releasing my previously published articles. Had they not done so, I probably wouldn't have continued the tinkering which resulted in this final solution to all XL-series video defects.

## Hackers Vs. XL Video

Like all good researchers, we Alchemists take a keen interest in the efforts of others who work along similar lines, and I must acknowledge their efforts. In the February 1986 isue of *Antic*, John Borland described how to restore the missing XL chroma signal to the output jack via a 220-ohm resistor. The resistance value was wrong, and this mod did nothing to improve basic video performance. But he was on the right track.

Again in November 1986, *Antic* published an article by Jon Krahmer describing how to bring out the missing chroma via a capacitor. While Krahmer deserves credit for pursuing the subject in the face of shamefully abusive treatment at the hands of Atari Corporation, his approach again did nothing to solve basic video defects and was the poorest method for restoring missing chroma to the output jack.

In the July 1989 *PSAN Magazine*, Rich Gratzer presented his fix for 1200XL video problems. It was strictly the work of an amateur: basic video defects were again ignored, and color shadows were somewhat reduced at the expense of color saturation performance. Most of the parts employed serve no real purpose. He concocted his hack on the basis of touching his fingers to the video components (!) and had a little difficulty recalling details to rationalize his approach.

Finally, I must give special mention to *AC*'s Bob Woolley for his efforts to remedy 1200XL video defects. Not because he was successful, but because he tried so hard. Bob did manage to clean up some of the mono problems, but the color demons held out firmly against him. In the August 1987, September 1989, July 1990, and November 1990 issues of the *SLCC Journal*, Bob went head-to-head with the 1200XL video beast. A few times he came close to slaying the dragon, but he ran out of gas just short of final victory. It must have been one of the few times the Invincible Woolley tasted defeat (or at least, something less than total success). One of his articles got posted to the 8-Bit Forum on CompuServe, where it continues to befuddle Classic Atarians to this day. But the sheer amount of guts and sweat Bob poured into the effort was impressive even by Alchemist standards.

## Genesis of Super Video 2.1

Following the 1991 *CN* article I felt sure I had finally solved all the 800XL video defects. In the elapsed two years, however, with hundreds of hours spent in front of my CRT, I began to notice more subtle things. Color performance still wasn't the best, and worst of all the brightness of my video display varied according to the electrical load on the power bus of my 800XL. I've modified my XEP80 so it draws power from the joystick port: it sucks half an ampere. The addition of stacked cartridges, a P:R:Connection, multiple operating systems and a 1088K RAM upgrade triples the power drain compared to the 700mA or so a stock 800XL draws (I run my system off a monster IBM-type switching power supply). With the addition of each new electrical load my CRT display grew dimmer. I was dismayed to realize that after all that work there were still a few gremlins I hadn't exterminated.

The culprit proved to be not the video circuit itself, but components involved in supplying power to the entire video circuit. The video circuit is isolated from the rest of the power supply by an 820uH inductor, L5. The function of this part is to pass clean DC voltage to the video circuit while suppressing any video RF interference that could make its way via the power bus into other parts of the computer where supply-line noise might disrupt the digital circuits. A prudent design—on paper, anyway.

In a perfect world, an inductor—which is nothing more than a little coil of wire—passes DC current perfectly but suppresses AC according to the inductance value (expressed in units called Henries). Well-made (but expensive) inductors come very close to achieving this theoretical level of performance. But a cheap one, wound with very thin wire, will exhibit the properties of a resistor as well as an inductor. In a DC circuit, resistors waste electrical energy by dissipating it as heat: the voltage coming out is usually lower than the voltage you feed in. This is a desirable characteristic when properly applied, but a disaster in the wrong environment. A resistance in series with the power supply is in this instance very definitely the wrong application.

So, did Atari use the nice expensive inductors that would only squelch the AC noise but not eat up any of those precious DC volts? Hah! Guess again! Of course you *know* they used the cheap ones! This is, after all, Atari: a company where the shaving of pennies was (and still is) the ultimate expression of Corporate Culture. A clue to the crummy inductor was provided by the low voltage on the collector of output transistor Q5: about 4.3V in most stock 800XL systems. Yet, the voltage on my motherboard's main supply bus measured 5.1V. Atari's cheapo inductor squandered 16% of the power available to the

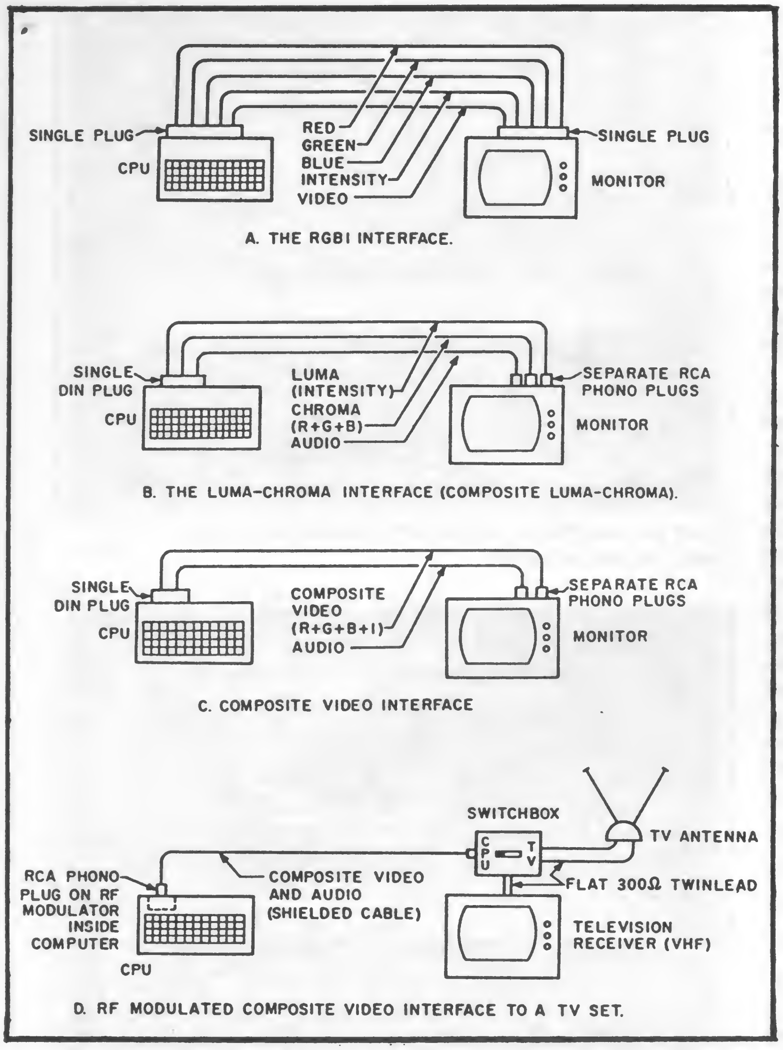


**Figure 1. Typical Video Interfaces for Home Computers**
**(A) Digital RGBI interface (CGA), all signals at TTL level, used in early IBM PC's. Video is actually three separate lines carrying baseband video, H-sync, and V-sync. For a monochrome display (MDA) only the Video, Sync, and Intensity signals are used. Most IBM monitors lack Audio.**
**(B) Luma-chroma interface for color monitors. A monochrome display is obtained if Chroma is disconnected. Luma alone can be used for best picture on a CV mono monitor. Not all monitors have Audio.**
**(C) Composite video (CV) interface. Used on color or mono monitors, poorer performance than Luma or Luma-Chroma interface.**
**(D) TV interface, RF-modulated CV connected through TV antenna and channel selector. Poorest performance, will ruin your eyes.**

video circuit! I pulled these inductors from several XL boards and measured their DC resistance: typically 10 ohms. Terrible! (It shouldn't be more than an ohm or two.)

In Super Video 2.1 (which I'll call S-V from now on) we'll replace this stupid inductor with a low-value resistor, beef up the associated filter capacitor to maintain a noise-free supply line, and make a couple minor changes in the video circuit to enhance color performance and signal strength a bit. S-V 2.1 will be "grafted" onto S-V 2.0, which I'll describe first. Before describing S-V 2.0 I'll give you some background on various video interfaces and provide a general description of the major video flaws in the XL-series machines. Then I'll follow up with instructions for installing S-V 2.1 in the 600XL and 1200XL.

## Video Interfaces

Figure 1 outlines various video interfaces used in home computers. Figure 1A is a simplified representation of the digital or TTL interface. This was used mainly in early IBM PC's, where it was implemented as CGA (Color Graphics Adaptor) for color monitors or MDA (Monochrome Display Adaptor) for text-only IBM monochrome displays. See Bob Woolley's excellent article elsewhere in this issue for information on installing an IBM-style MDA interface in your Classic Atari.

Figures 1B-1D show the analog (NTSC or PAL) interfaces traditionally used in Atari 8-bit computers. The luma-chroma interface in 1B offers the best overall performance but requires a more expensive monitor that will accomodate the various inputs. You'll want this type monitor/interface to obtain best results with color monitors, and I consider it mandatory for videogames.

Figure 1C works well with monochrome composite monitors, especially if you employ the Atari's luma output instead of the standard composite output. This type of monitor/interface provides the highest screen resolution and is ideal for wordprocessors, spreadsheets, databases, or other text-oriented work; it's also inexpensive. Color composite monitors give a coarser display compared to luma-chroma, but at least they usually always have built-in sound. Mono composite monitors often don't have an audio input, so to get audio you have to run the audio line to a stand-alone audio amplifier and speaker. A major disadvantage to both the luma-chroma and composite video interfaces is a real scarcity of composite analog monitors in today's market.

I presently know of only one model of composite monitor still being manufactured: the Magnavox 1CM135. It's available from Midwest Micro (6910 U.S. Route 36E, Fletcher OH 45326 USA, orders 1-800-552-8080 toll-free) for only $249. Its performance is impressive. It accepts CGA or MDA TTL inputs, luma-chroma or composite video analog inputs, and even has stereo audio for all you GUMBY fans. This monitor produces very decent color video for an IBM, Atari ST, any Atari 8-bit except the 400, and your VCR. The Magnavox 1CM135 continues a tradition established by the Commodore 1902 and 1084 series monitors, which had similar characteristics and were produced for Commodore by Philips, the parent company of Magnavox. The Commodore 1084 series monitors were still in production as recently as 1990. Fortunately, analog monitors are popular items at electronic surplus outlets and turn up frequently at computer fairs, swap meets, and even the Swap ads in the back of *AC*.

Figure 1D shows the connection to a TV set. This is probably what most people use when they first bring the computer home. Very quickly, you discover how horrible the TV interface is: rippling herringbone patterns accompany the usual grain, blur and smear, to the accompaniment of an annoying buzz from the TV's speaker. Even under ideal conditions the TV interface is at best poor, due to the limited video bandwidth response of most TV's (4.5MHz vs. 15MHz or more for a monitor) and signal leakage into the computer video signal from adjacent broadcast channels in the TV's tuner. A guaranteed recipe for eyestrain headaches!

## The Sunnyvale Butchers

Noboday at Atari Corporation *ever* understood composite video. And they still don't. (Got an STe? Try connecting it to a high-quality monochrome composite monitor in medium- or lo-rez with a Monitor Master. The resulting display is a disgraceful abomination.)

The Video Butchers in Sunnyvale committed their most gruesome atrocities on the XL machines. For starters, they omitted bringing out the chroma signal to the rear jack on all the XLs. They carried this concept a step further in the

600XL by omitting the luma signal as well. A gross design error appeared in the form of mismatched signal impedance in the video output: Atari gave it 100 ohms, but the standard impedance for unbalanced video lines is 75 ohms, resulting in a weakened signal which is prone to interference from external RF sources.

No matter, some blithering idiot at Atari's Hong Kong factory installed 390 ohms, so that all Hong Kong-made 800XL REV A2 and REV C motherboards were cursed with an output mismatch even worse than what was built into Atari's original flawed design. When Atari later shifted production to Taiwan some genius noticed the 390-ohm error and "corrected" it back to the original 100-ohm error, so video in the Taiwan 800XLs improved somewhat.

These scandalous incompetencies were bad enough, but the Butchers weren't done yet. They hung bypass capacitors on the XL video lines to suppress RFI. What they accomplished instead was to filter off the high-frequency content of the video signal, where the resolution resides. Result: fuzzy video that stays fuzzy no matter how much you twiddle the focus control on your monitor. This capacitance was omitted in later production Taiwan models, which along with the impedance "correction" previously mentioned helped improve performance in later units. Circuit layouts in all models permitted color clocking signals to leak into the monochrome circuits, so you get that wonderful grainy background on your monitor even when you use the hi-rez luma output.

The 600XL presents the saddest case. Atari's original design for 600XL video was essentially identical to that for the 800XL. Then Jim Morgan, pathetic master bean-counter from Philip Morris Tobacco Co. (I worked at Philip Morris and met Jim once, I was not impressed) came along just as the 600XL was commencing production and tried to cure Atari's financial follies by slashing all the main video components from the 600XL, reducing it to a primitive TV interface. To add insult to injury there's a wrong-value coupling capacitor in the color circuit in some units, causing washed-out color. Thus gutted, the 600XL never sold well. Atari saved maybe 27-cents worth of parts from these myopic blunders, in the process saddling the user community with a legacy worthy only of disgust.

The failure of so many hackers to cure the problems of the 1200XL is entirely understandable, for in that machine the Butchers accomplished their supreme achievement. In one of his "Clearpic" articles, Bob Woolley commented something to the effect that "Atari engineers must have been paid by the component". I quite agree. The 1200XL video circuits are the most complex of all the XL/XE machines, and video performance is absolutely the worst. Many of the extra parts don't seem to serve any useful purpose, and quite a few of them seem to have been placed there expressly to degrade performance. The entire design incorporates virtually all the blunders thus far mentioned, plus a fistfull of new ones: it's so outrageously bad as to approach the realm of the incomprehensible. The irony of it is, Atari intended the 1200XL to be the anchor of an XL product line with improved video! As we shall see, after a bit of Applied Alchemy the 1200XL indeed has the best video performance of any 8-bit machine Atari ever made.

Figure 2 demonstrates in actual screen photos the various stages of video quality. These photos lose much detail in print, but even so you can see a big difference between 2A and 2D. Study these photos with a magnifying glass: the details should still be visible (I hope!). If your XL video looks like 2A, 2B, or 2C, and you'd like it to look like 2D, read on! (You 130XE folks will have screens that look like 2C; see Charles Cole's "Super Video for the XE" elsewhere in this issue if you want to upgrade your XE video.)

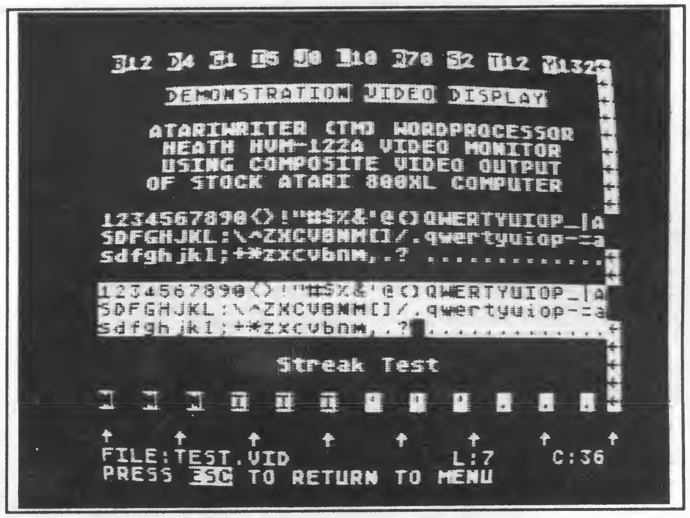


**Figure 2A. Composite video output of stock 800XL: worst case grain, blur and smear.**

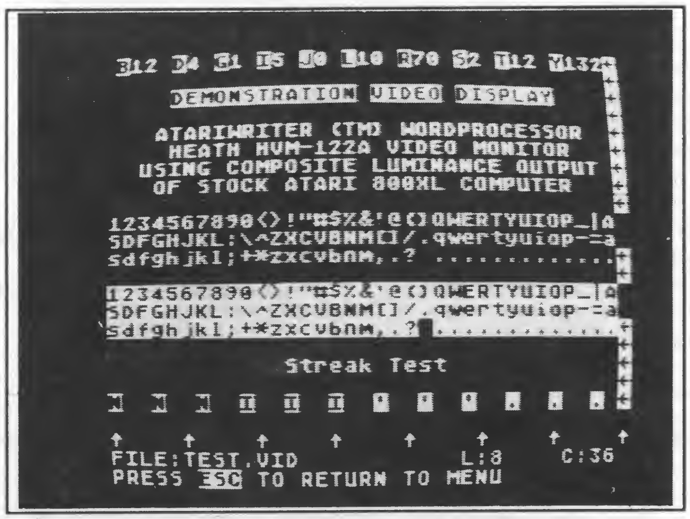


**Figure 2B. Monochrome display of stock 800XL using luminance output: grainy background reduced but display is still blurry and smeary.**

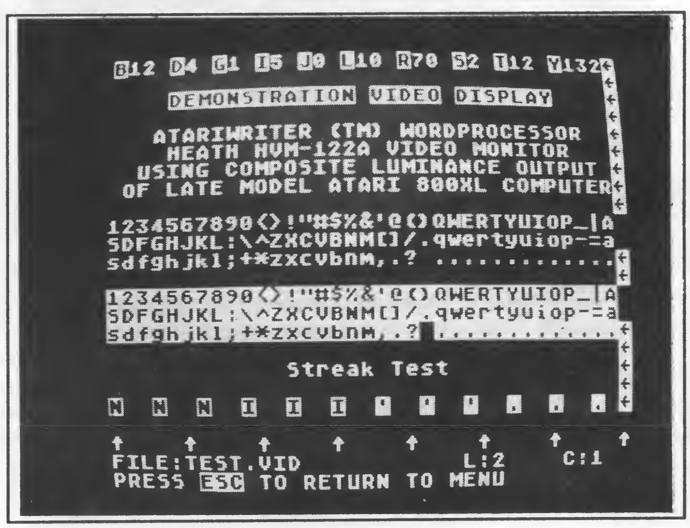


**Figure 2C. Luma output of late-model (Taiwan) stock 800XL: sharpness much improved but background is still grainy. XE machines also look like this.**


Figure 2D. Luminance output of Super Video modified 800XL:

## Super Video 2.0 For the 800XL

We'll do S-V 2.0 first; it's the easiest of the upgrades and yields spectacular results. You might elect to stop after doing S-V 2.0, since going further with 2.1 brings diminishing returns for more work. I guess I need to make a disclaimer here: if you try any of these mods and botch it, tough krinkles. The Alchemist, Staff and Publisher of *AC* won't be responsible for people who mangle their machines (or themselves) trying to do this stuff. You'll need resistors, capacitors, heat-shrink tubing, and a panel-mount SPST mini toggle switch, all available at Radio Shack. Buy the resistor assortment pack #271-312: it contains all the resistors you'll need in exactly the proper wattage and physical size, with plenty left over for future hacks. Figures 3 and 4 show the "before and after" schematics. The schematic of Fig. 4 essentially represents the upgrade as it will appear in all three XL machines. Only the component designations will differ.

OK, let's get our hands dirty. Remove the six screws from the bottom of the case and separate the case halves. Remove the motherboard fastening-screws, and wiggle the board free of the case. Make sure you discharge yourself to some large (preferably grounded) metal object before removing the motherboard RF shields, and handle it only by the exposed broad foil ground plane strip around the edges. Place the board on a conductive surface (damp newspapers will suffice), and orient it according to the diagram in Fig. 5.

## By The Numbers...

Study Figures 5-7 and refer to them for the following steps:

**Step 1.** Locate resistor R53. It will be either 390 ohms (orange-white-brown-gold) or 100 ohms (brown-black-brown-gold). Solder a resistor in parallel with R53 as follows: If R53 is 390 ohms, solder a 100-ohm resistor (brown-black-brown-gold) on top of it in parallel (see Fig. 6); if R53 is 100 ohms, solder a a 330-ohm resistor (orange-roange-brown-gold) on top of it in parallel. (This restores the mono output impedance to the correct value.)

**Step 2.** Locate the 180pF glass capacitor C56 and snip it off the board with fine wirecutters. (This improves video high-frequency response.)

**Step 3.** Locate R116, a 51-ohm resistor (green-brown-black-gold). Solder a 2.2-ohm resistor (red-red-gold-gold) on top of it in parallel. (This improves output current flow to Q3, which is "starved" for current in Atari's original design.)

**Step 4.** Select a 10uF/16V tantalum capacitor and bend the leads outward. Notice one lead is marked with a (+) sign. Position this part above the board so the (+) lead touches the bottom of the R116/2.2-ohm combination while the (-) lead touches the top of R66. The leads are too long. Cut them off right where the leads contact the respective resistors, then solder the cap in place. (This improves Q3's transient response and filters noise from the supply line feeding the video output.)

**Step 5.** Locate R66, a 100-ohm (brown-black-brown-gold) resistor. Solder a 330-ohm resistor (orange-orange-brown-gold) on top of it in parallel. (This lowers the impedance of the color signal output to the correct value.)

**Step 6.** Now we'll install the CV Disable switch. The pur-

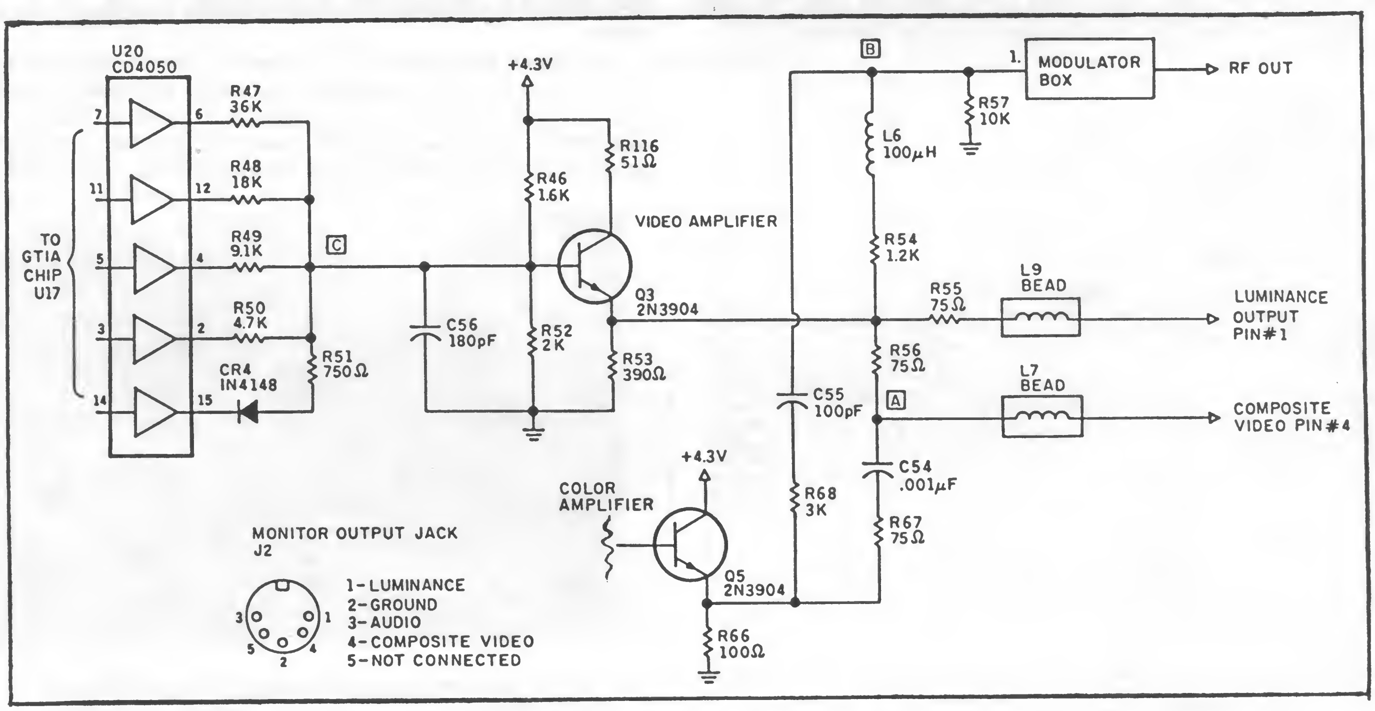


Figure 3. Stock 800XL video output circuit.

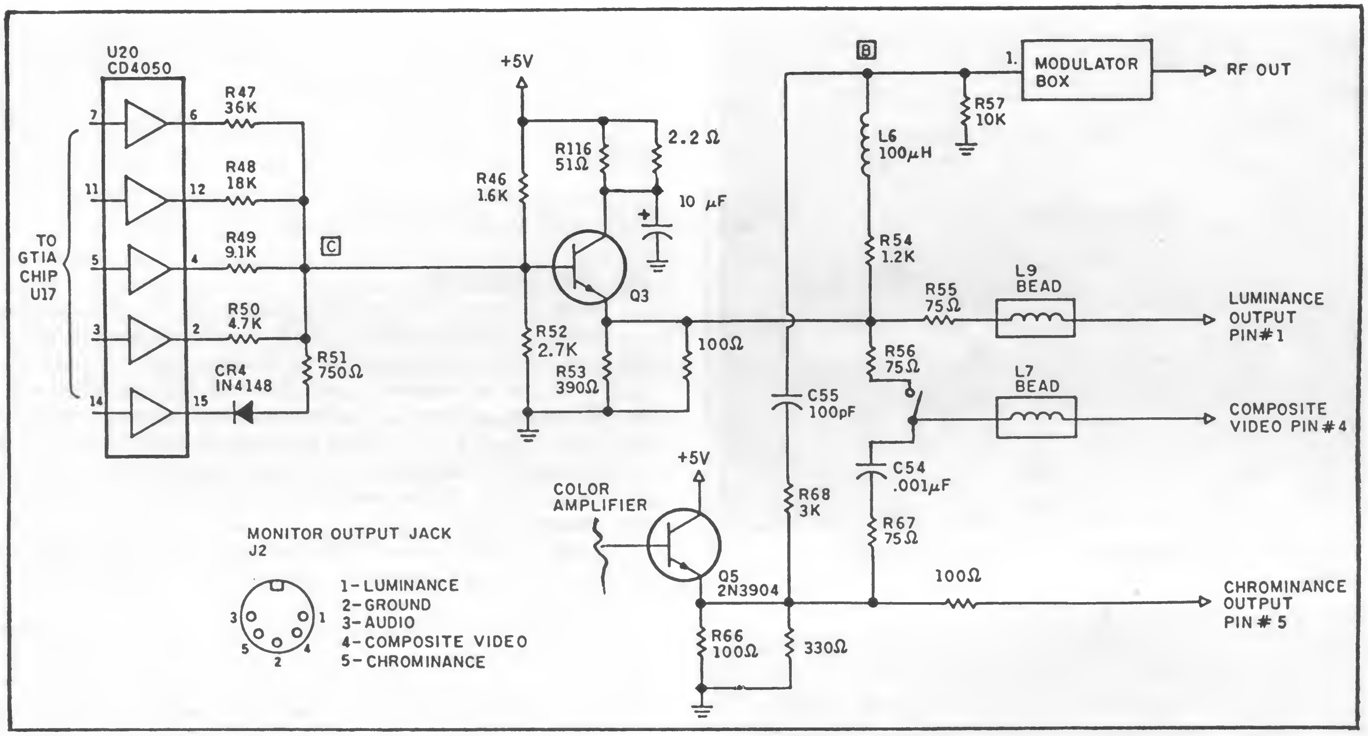


**Figure 4. 800XL video circuit after Super Video modification.**

pose of this switch is to enable composite video for users whose color monitor accepts composite video only. Those who use luma or luma-chroma interfaces should toggle the switch to disable composite video. A cleaner signal, free of color clocking interference that makes the screen background grainy, will be obtained. Cut two 8" lengths of wire and strip 1/4" insulation from one end of each. Solder the stripped ends of each wire to the two lugs on the switch. Twist these wires lightly as shown in Fig. 6. At the unattached ends, snip off 1" from one of the wires, then strip 1/4" insulation from the ends of both wires. Set the switch assembly aside temporarily.

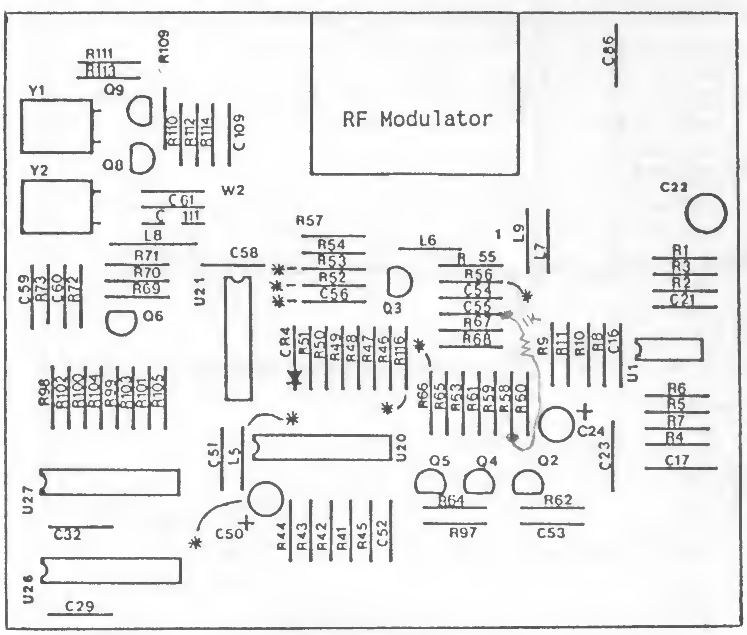


**Figure 5. Critical video components on 800XL**

Now locate R56 on the motherboard, a 75-ohm resistor (violet-green-black-gold). We want to desolder the left end of this resistor (DON'T cut it!). Get a good grip on the left end with needlenose pliers, then apply your soldering iron to the joint at a 45-degree angle so it firmly contacts both the resistor lead and the solder pad. Allow sufficient time for the joint to heat up—about 10 seconds, the solder will start to bubble. With the iron still in place, pull up smoothly but firmly with the pliers: the resistor should come up easily. If it doesn't, allow a good 5 minutes for everything to cool down, then try again.

Once the left end of R56 is free, use the needlenose pliers to form the free lead end into a loop. Then bend the resistor into a vertical position supported by the end still soldered to the board. Clear the vacated hole of solder. Now retrieve the prepared switch assembly and solder the longer wire to the va-

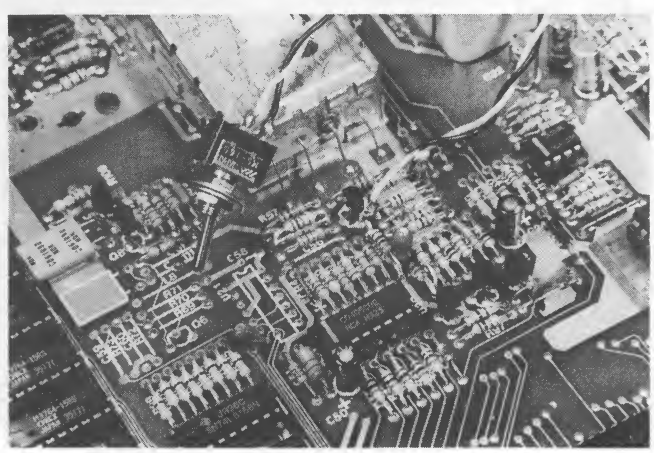

**Figure 6. 800XL motherboard after Super Video modification. Note CV Disable switch, empty space for C56, doubled resistors, tantalum capacitor.**

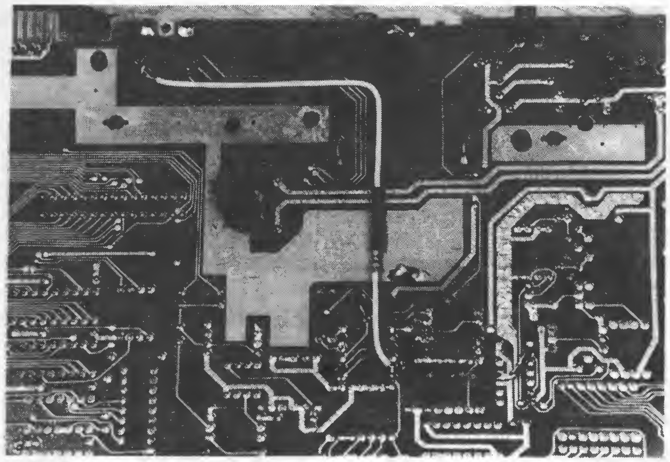

Figure 7. Foil side of 800XL motherboard showing Chroma pick-off resistor

cated R56 circuit board hole. Solder the shorter switch wire to the loop at the top of R56.

**Step 7.** Now we'll install the chrominance pick-off resistor. Select a 100-ohm resistor (brown-black-brown-gold), and to one end of it apply a length of insulation (stripped from wire) leaving only 1/8" of the lead exposed. Cut a 5" length of wire and strip 1/4" insulation from each end, then solder this wire to the uninsulated end of the resistor. Now experiment a little to find the smallest diameter heatshrink tubing that will fit over both the solder bulge and the resistor body, then snip off a length sufficient to cover the bare lead from the resistor body to the solder junction plus an extra 1/4" to overlap both ends. Slip the tubing into place, then warm it by holding the assembly 1/4" above your hot soldering iron while slowly rotating it for even heating. The tubing will contract to make a neatly insulated assembly (see Fig. 7). DO NOT use tape to insulate this resistor!

Solder the short end of the prepared resistor to the junction of R67-R68 on the foil side of the board. Solder the other end to pin 5 of the monitor jack, routing the wire through the gap between the ground plane foils as shown. Keep the wire close to the board. I later added a dab of hot-melt glue at the bend in the wire to secure it in place.

**Step 8.** On the rear panel of the case, at a point 1" above the bottom of the panel and midway between the monitor jack and the TV output jack, drill a hole for mounting the composite video enable/disable switch. The exact size of the hole depends on the diameter of the mounting stem of the switch. This completes the S-V 2.0 modification for the 800XL.

## 800XL S-V 2.0 Checkout

Place the bare board on a clean insulated surface (formica kitchen tabletops work well) and attach the power supply and video cables (a good monochrome monitor with luma connected is preferred here). Turn on the power (yes, the 800XL boots up fine without keyboard or shields installed). You should see BASIC's "READY" notice and cursor appear on your screen, brighter and clearer than ever before. Adjust the monitor's brightness and contrast controls so you can see the entire display, including the background. Work the CV Disable switch back and forth as you study the screen background. You should see a grainy background appear and disappear as you toggle the switch. Some monitors reveal this better than others, and it's harder to see if the focus control on your monitor is out of adjustment. On color monitors you might not see it at all.

If you're satisfied with your accomplishments to this point and don't wish to go further, reattach the RF shields to the board (route the switch wires out near the RF modulator), reinstall the board, fasten the switch to the rear panel, and close up the case. However, if you aren't afraid of more work and would like to push video performance to its very limit, keep that iron hot and move on to Super Video 2.1!

## S-V 2.1 For The 800XL

If you have a RAMBO or other memory upgrade card installed, unplug it and keep it out of the way. Refer to Fig. 5 for the following steps:

**Step 1.** Locate 820uH inductor L5, usually a green-colored component that looks like a resistor with gray-red-brown-silver bands, directly in front of the 4050 chip U20. Desolder or snip out this part, then clear the vacated board holes with a solder sucker. Select a 2.2-ohm resistor (red-red-gold-gold), solder it in place of L5, and snip off the excess lead length. (This improves current flow to the entire video circuit.)

**Step 2.** Locate electrolytic capacitor C50 (10uF/10V): it's adjacent to the L5 inductor you just replaced. Desolder this capacitor and clear the vacated holes of solder. Replace C50 with another electrolytic capacitor of at least 100uF/10V rating. Radio Shack parts vary considerably in their physical dimensions, so when you're shopping be sure to examine all the parts packages in the range of 100 or 220uF of radial-lead electrolytics on the shelf in the store. Select whichever gives the largest uF value in the smallest physical size. I was able to squeeze in a 220uF unit and still didn't have trouble reinstalling my RAMBO board. (Restores AC filtration lost by removal of L5.)

**Step 3.** Locate 2K resistor R53 (red-black-red-gold) directly to the left of Q3 on the motherboard. Remove this resistor and replace it with a 2.7K resistor (red-violet-red-gold). (Improves color saturation slightly.)

**Step 4.** Solder a 1K resistor (brown-black-red-gold) from the right side of 100pF capacitor C55 to the bottom end of 6.2K resistor R58 (blue-red-red-gold). This resistor has to traverse about 1.5" of board space, so don't trim the leads. Mount it about 1/4" above the board on the component side, bending the leads down at the specified contact points. This resistor provides negative feedback around the color amplifier Q2-Q4-Q5. The effect is subtle, but it improves saturation a little and reduces color shadows somewhat.

This completes Super Video 2.1 for the 800XL. You'll probably find it necessary to reduce your display brightness controls when you perform your checkout, as the video signal is now stronger than it was with S-V 2.0. Check out the improvement on a color monitor if available before you close up the case. Use the luma-chroma interface to check proper operation of your chroma circuit wiring. For my color checkout I just stuck my Pole Position cart in the slot and booted up the bare board. Pole Position is nice because it's very colorful and self-starting. The display was wonderfully sharp and brilliant on a Commodore 1084 using the luma-chroma interface with composite video disabled. The Alchemist succumbed to several hours of game-playing after reassembling the computer. Unfortunately the crisp display didn't improve my driving, and those fiery crashes were all the more annoying for their clarity. Hrrrumph!

## S-V 2.1 For The 600XL

For the remainder of this article I'm going to revert to a more truncated style of presentation in the hope of saving page space. Physically, S-V 2.1 in the 600XL is tedious, as boardspace alotted to the video components is rather a mini-

scule piece of real estate. Consequently the video circuitry is densely packed, and you'll have to mount most components vertically. With this upgrade we have a lot of labor to perform, since we'll be adding all the parts Atari swindled from us as well as replacing the bungled ones they installed.

The resistors, capacitors, and switch are all available at Radio Shack. You'll need three 2N3904 (MPS3904) transistors, also at Radio Shack (#276-2016). If the 3904 is unavailable you can substitue the 2N2222 (MPS2222), #276-2009. Don't take the specs and diagrams printed on the packaging too seriously: a 2N3904 and MPS2222A I purchased both showed the collector and emitter leads reversed on the package diagram. (I verified the leads on the actual parts with a click tester; they were correct. I long ago learned not to trust data furnished with the Rip-Off Shack's overpriced parts.) When installing these transistors, line up the flat side of the part with the flat side in the outline screened on the board.

You'll also need a 5-pin DIN board-mounted socket: that's a problem. These sockets are used in all IBM computers and are available dirt-cheap at every electronics outlet in the world. Except Radio Shack. Best Electronics sells them for $1.00 apiece. The problem is that no mailorder parts vendor wants to bother with an order for a single part that costs less than a buck. You'll have to be creative. Band together with friends or your usergroup and buy a whole bunch of them, or combine your order with other items. Perhaps some shrewd operator will stock up on them and offer them to *AC* readers through the Swap ads in the back of this magazine.

Refer to Fig. 8 for the following steps:

**Step 1.** Desolder and clear all the board holes for the following components:

| | | | | | | |
|---|---|---|---|---|---|---|
| C111 | J7 | Q8 | R128 | R131 | R134 | R137 |
| C112 | L12 | Q9 | R129 | R132 | R135 | R138 |
| C113 | Q7 | R124 | R130 | R133 | R136 | R139 |

**Step 2.** Remove the following components from the circuit board and clear the vacated holes of solder:

C109, C110, C115, L14, R59, R123, R127, R140, channel selector switch

**Step 3.** Install the following components at the indicated locations:

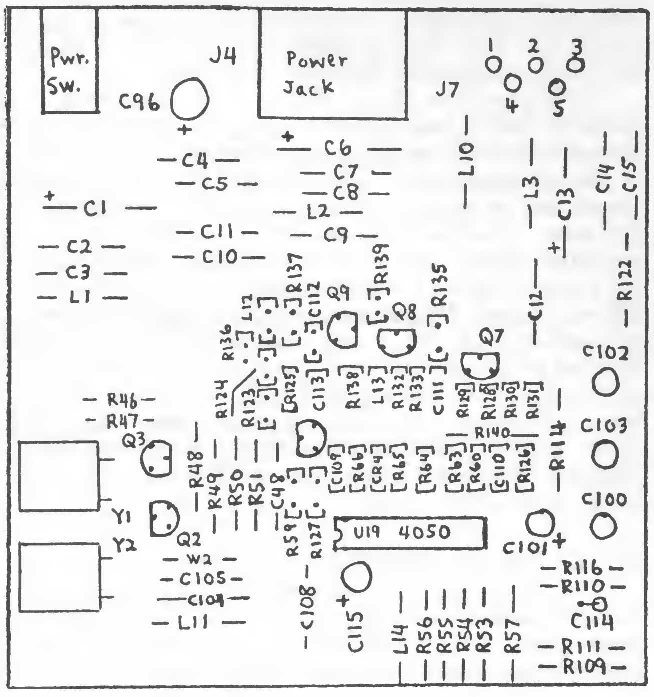


Figure 8. Parts placement for the 600XL

| Part | Value | Code/Mark | Location |
|---|---|---|---|
| Blank space | - 0 - | - - - | C109 |
| Capacitor, ceramic | 100pF | 101 | C110 |
| Capacitor, ceramic | 5pF | 4.7 or 5 | C111 |
| Capacitor, ceramic | .001uF | 102 | C112 |
| Capacitor, ceramic | 100pF | 101 | C113 |
| Capacitor, rad. elect. | 220uF/16V | 220/16 | C115 |
| Switch (1) | SPST | - - - | L13 |
| Resistor | 2.2 ohms | red-red-gld-gld | L14 |
| Transistor | 2N3904 | 2N(MPS)3904(2222) | Q7 |
| Transistor | 2N3904 | 2N(MPS)3904(2222) | Q8 |
| Transistor | 2N3904 | 2N(MPS)3904(2222) | Q9 |
| Resistor | 1.5K | brn-grn-red-gld | R59 |
| Resistor (2) | 75 ohms | [brn-grn-brn-gld]x2 | R123 |
| Resistor (2) | 75 ohms | [brn-grn-brn-gld]x2 | R124 |
| Resistor | 2.2K | red-red-red-gld | R127 |
| Resistor (3) | 6.2K | [orn-blk-red-gld]x2 | R128 |
| Resistor | 1K | brn-blk-red-gld | R129 |
| Resistor | 2.2K | red-red-red-gld | R130 |
| Resistor | 1K | brn-blk-red-gld | R131 |
| Resistor | 1K | brn-blk-red-gld | R132 |
| Resistor | 3.3K | orn-orn-red-gld | R133 |
| Resistor | 10K | brn-blk-orn-gld | R134 |
| Resistor | 220 ohms | red-red-brn-gld | R135 |
| Resistor (2) | 75 ohms | [brn-grn-brn-gld]x2 | R136 |
| Resistor (2) | 75 ohms | [brn-grn-brn-gld]x2 | R137 |
| Resistor | 3K | orn-blk-red-gld | R138 |
| Resistor (4) | 4.7K | yel-vio-red-gld | R139 |
| Resistor | 1K | brn-blk-red-gld | R140 |

Notes :
(1) Two 7" lengths of stranded wire, lightly twisted, from switch lugs to L13 holes.(CV disable switch)
(2) Synthesized value: two 150-ohm resistors in parallel.
(3) Synthesized value: two 3K resistors in series.
(4) Designated R141 in Atari diagrams (schematic error).

**Step 3.** On the foil side, cut the foil connection between pins 2 and 5 of J7.

**Step 4.** Install the 5-pin DIN jack on the component side of the board. Depending on the particular style of unit, it might be necessary to file down the two front pins to get them in the holes. Solder all the pins, including the two front ones.

**Step 5.** Now we bring out the luminance signal to the jack. Twist together two 150-ohm resistors (brn-grn-brn-gld), solder the leads together, and place insulation (removed from wire) over all but 1/8" of the exposed lead length on both sides. On the foil side of the board, solder one end of this part to the junction of R123-R124 and the other end to pin 1 of the output jack J7. Depending upon lead length, you might have to add a short length of insulated wire to one end of this part. Mine barely made it without adding extra wire.

**Step 5.** Now we'll bring out chroma to the jack. Select a 100-ohm resistor (brn-blk-brn-gld) and place insulation (removed from wire) over all but 1/8" of the exposed lead length on both sides. On the foil side of the board, solder one end of this part to pin 5 of output jack J7, and the other end to the emitter lead of Q9. This lead is on the left when you look at Q9 face-on.

**Step 6.** On the bottom half of the RFI shield, locate the square hole where the channel selector switch used to be. Cut out all the metal above this hole, extending to a distance of about 2mm on either side of the hole, and all the metal below the hole down to the bend. You'll end up with a square-looking version of the big notch already present for the adjacent power supply jack.

We have to cut another notch for the CV Disable switch. Viewing the RF shield from the rear, cut a notch 18mm wide commencing at a point 3mm to the left of the hole already present for the RF output jack. This notch should extend all the way to the bend in the metal. You'll lose a shield mounting tab, but that doesn't matter.

Cutting these notches isn't easy. I used a Moto-Tool equipped with an emery cutting wheel to do a neat job, and I filed down burrs and sharp edges with a fine Swiss file. Tin snips might also work but would probably warp the metal.

Heavy-duty wirecutters might also suffice, though they might not be much good for anything else when you're done. Sheet metal is a pain.

**Step 7.** Now we have to make holes in the rear panel outer case, starting with the hole for the video jack. Measure off a point exactly 21mm to the left of the leftmost edge of the power connector hole. Make an indent there to start your drill bit, then drill a 3/4" hole. If all goes well you'll completely obliterate the existing rectangular opening where the channel selector was. In my experience it's better to have an opening too large than too small. Square off the edges of the hole with a round Swiss file. On my unit I filed off the "2 - CHAN - 3" lettering, which is now meaningless.

Now for the CV Disable switch hole. At a point 25mm from the bottom of the rear panel, and 13mm to the left of the leftmost edge of the RF modulator hole, drill a hole for your switch. The diameter of this hole should be just slightly larger than the mounting stem of your switch (I used a 3/8" bit). If you follow these instructions exactly, everything should fit perfectly when you reassemble the case.

## Checking Out The S-V 2.1 600XL

Boot up the bare motherboard with your favorite monitor as described earlier for checking out the mod on the 800XL. After upgrading my 600XL I was pleased to observe a crisp display in both mono and color whose characteristics were identical to the results I obtained with the 800XL, including the function of the CV Disable switch. After you're satisfied everything is running OK, reassemble the shields and case and close it up.

Those of you who still want to use the TV interface on your 600XL might be concerned about the loss of the channel selector switch. It's actually still there: removing the switch is equivalent to leaving the selector permanently set on the Channel 3 position (I haven't verified that). If you're really very fussy about this you can always run some wires from the channel selector switch holes in the vicinity of J7 out to another SPST switch mounted on the rear panel—if you can find room for it! Having gone to all this trouble installing the electronics for interfacing my 600XL to a nice crisp monitor, I don't give a hoot about the TV interface any more.

## Perspectives On 1200XL Video

Despite the abundance of extra parts in the 1200XL video section, it turns out the basic design of the 1200XL video amplifiers isn't much different than the ones in the 800XL and 600XL. In all three machines color is handled by a group of three transistors, while the baseband monochrome/composite output is a separate single-transistor circuit. All these transistors are 2N3904 types. The table below summarizes the schematic designations of these transistors and briefly describes their functions:

| Function | 600XL | 800XL | 1200XL |
|---|---|---|---|
| 1st color amp | Q7 | Q2 | Q19 |
| 2nd color amp | Q8 | Q4 | Q8 |
| Color output | Q9 | Q5 | Q7 |
| Mono/CV output | Q6 | Q3 | Q11 |

Atari's most serious design and manufacturing flaws occurred in the baseband mono circuit, which screwed up both mono and color.

What sets the 1200XL apart from the other XL machines is an extra three-transistor circuit (Q16-Q17-Q18) whose input connects to the color sync signal at GTIA pin 25. The output is emitter-coupled to the color amp circuit via a diode (CR19) to Q19. It took me a while to dope out what this was for, but once I caught on my imagination was gripped in a spell of astonished wonder. This extra little circuit boosts color saturation. And The Alchemist is here to tell you its effect amounts to video magic. If Atari had included this extra 25-cents' worth of parts in all its 8-bit machines, and hadn't squandered it by butchering the rest of the video circuitry, the Atari 8-bit could have blown away the competition hands-down. Especially for color graphics and games!

Curing the video defects in the 1200XL was no easy task: the gremlins were well-entrenched with multiple lines of defense, and they fought The Alchemist tooth and nail every inch of the way. But, as General Grant discovered in the American Civil War, the secret of victory lay in lessons learned from the battles fought. That secret is to achieve a balance between three conflicting elements of the color output, which are: 1.) color saturation; 2.) color shadows; and 3.) sharpness (signal strength and bandwidth). The main rule of the game is: "Anything you do to improve one of these elements will necessarily degrade performance of at least one, and probably both, of the other two." Insofar as the monochrome amplifier plays a key role in achieving the best color display, improving the color display automatically results in optimized monochrome performance.

My philosophy was to tolerate a certain amount of color shadows while maximizing sharpness and saturation. This approach provides maximum benefit for both mono and color users. Color shadows don't affect the monochrome display at all, while the optimized signal provides the best possible screen sharpness for text. On color displays, the eye tends to be more forgiving of object shadows if the picture is sharp and clear and full of brilliant color. Object shadows in the color display seem to me a video artifact that varies according to the particular combination of colors on the screen, being absent with some combinations and more noticeable with others. The S-V 2.1 upgraded 1200XL still exhibits some color shadow artifacting, but I'm gambling most people won't notice it while they're playing a fast-moving videogame on a crisp, vividly colored screen. In short, you game freaks will have a field day playing color games on a 1200XL upgraded to S-V 2.1XL using a luma-chroma interface.

## S-V 2.1 For The 1200XL

OK, let's do it. Refer to the board layout diagram in Fig. 9 for the following steps.

**Step 1.** Cut out the following components from the motherboard:

```
C60       CR20
C62  (1)  R25
C101 (1)  R28
(1) Might not be present in some computers.
```

**Step 2.** Carefully *desolder* capacitors C103 and C104. One of them will be re-used. You don't have to clear the vacated board holes of solder.

**Step 3.** Desolder the following components from the board and clear the vacated board holes of solder:

```
C63   L15   R145 (1)
C99   R21   R181
C115  R44   R187
(1) Might not be present in some computers.
```

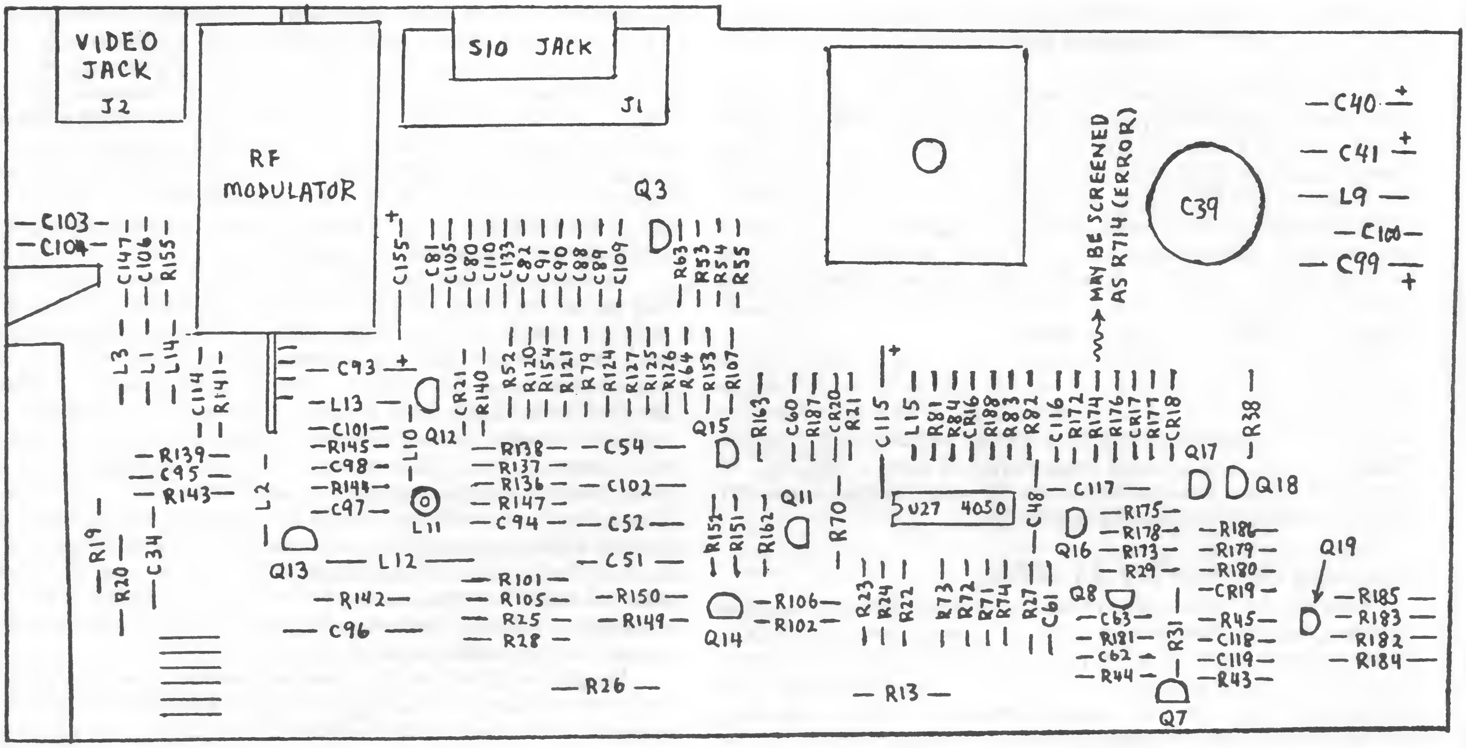


**Figure 9. Parts placement diagram for the 1200XL.**

**Step 4.** Install the following components at the indicated locations:

| Part | Location |
|---|---|
| Capacitor, glass ceramic,.001uF (1) | C63 |
| Capacitor, electrolytic, 220uF/16V (2) | C99 |
| Jumper wire | C115 |
| Resistor, 100 ohms (brn-blk-brn-gld) | L15 |
| Resistor, 1.5K (brn-grn-red-gld) | R21 |
| Resistor, 75 ohms [brn-grn-brn-gld]x2 (3) | R44 |
| Resistor, 10K (brn-blk-orn-gld) | R145 |
| Jumper wire | R181 |
| Resistor, 2.7K (red-vio-red-gld) | R187 |

Notes :
(1) Use one of the caps removed in Step 2 above.
(2) Use either a radial- or axial-lead unit; axial is preferred if you can find one that fits.
(3) Synthesized value: two 150-ohm resistors in parallel.

**Step 5.** Select a 120-ohm resistor (brn-red-brn-gld). Bend the leads and cut to an appropriate length, and solder this resistor in parallel on top of R23 on the component side of the board.

**Step 6.** Prepare a synthesized 75-ohm resistor by twisting two 150-ohm resistors (brn-grn-brn-gld) together in parallel and soldering the leads together. On the component side of the board, solder one end of this part to the top of R22 and the other end to the bottom of C48.

**Step 7.** Select a 120-ohm resistor (brn-red-brn-gld). Trim one lead to a length of about 1/2". On the component side of the board, solder the short lead of the 120-ohm resistor to the top of R24, and allow the 120-ohm resistor to stand vertically. Now, carefully desolder the bottom end of R24 and clear the vacated hole of solder. Stand up R24 vertically alongside the 120-ohm resistor, and solder the free ends of the two resistors together. You should have at least 1/2" of lead length remaining at the free end. Form this extra length into a small loop about 3mm in diameter and trim off any excess.

**Step 8.** Cut two lengths of stranded wire 10" long and strip 1/4" of insulation from both ends of each. Select a panel-mount SPST switch and solder one end of each wire to each lug. Twist these wires lightly through their whole length. Solder one end of one wire to the loop at the top of R24 you made in Step 6 above.Solder the other wire to the hole in the circuit board vacated by the bottom end of R24.

**Step 9.** Select a 330-ohm resistor (orn-orn-brn-gld). Bend and trim the leads appropriately, then solder this part in parallel on top of R45 on the component side of the board.

**Step 10.** Select a 100-ohm resistor (brn-blk-brn-gld). Place insulation (removed from wire) on both leads, leaving only 1/4" bare lead exposed. Now cut a length of insulated wire 10" long and strip 1/4" insulation from both ends. Solder one end of this wire to one lead of the resistor and insulate the joint with heatshrink tubing (NOT tape!). Now turn the 1200XL motherboard over and examine the foil side. What you want to look for are "channels" created by rows of resistors on the component side: we'll use these channels to route the chroma signal wire to the output jack. There are four of them; it will help to mark their location with a pencil. The first "channel" begins with R43 and ends with R186. The second begins with CR18 and ends with R153, the third at R107 and ends with CR21, and the fourth at R155 to end at C147.

Now locate R45 on the foil side of the board directly in front of Q19. On the foil side, solder the resistor end of the resistor-wire assembly to the end of R45 that's furtherest away from Q19. Bend and shape the resistor leads and wire so the resistor body lies in the middle of "channel 1", makes a right-angle bend to run down the middle of "channel 2" and a 45-degree bend to run down the middle of "channel 3", followed by a final 45-degree bend to run down the middle of "channel 4". This will bring the wire out close to the jack. Route the end of the wire through the break in the ground foil plane and solder the bare end to pin 5 of the output jack. This pin is easily located because it's the only one without a foil trace connected. Place three or four tiny dabs of hot-melt or silicone adhesive along the path of the wire to hold it in place on the underside of the board.

**Step 11.** Drill a hole in the rear panel of the bottom case directly above the channel selector switch, using a bit of appropriate size to match the mounting stem of your switch. Mount the CV Disable switch here after routing the wires out through the crack between the RF shield and the modulator box. This completes the modification.

## 1200XL Checkout and Wrapup

Boot up the bare 1200XL motherboard (preferably with a cartridge installed) with a monitor attached as described for the 800XL and 600XL upgrades. Observe the effect of the CV Disable switch, most visible on a monochrome monitor. (The effect of the switch is usually not observable on color monitors.)

If you're using a color display with a CV or luma-chroma interface, you'll notice how sharp and brilliant the colors now are. If you desolder one end of CR19 and lift it from the board, you'll have a color display that's identical to the color displays generated by the other S-V 2.1-upgraded XLs: sharp and clear, but with less vivid colors. Removing CR19 disconnects the saturation boost circuit; I think it looks better with CR19 left connected. Perhaps some enterprising hardware entrepreneur out there will make up a little circuit board kit for retrofitting Atari's saturation boost circuit to the other XLs; the electronic parts cost less than 50 cents.

## Monitors

For testing purposes throughout this project I used the following monitors: Apple A2M2010 green-screen monochrome (luma interface), Commodore 1902 and 1084 (luma-chroma and CV interfaces), Amdek Color 300 (luma-chroma and CV), Magnavox 1CM135 (luma-chroma and CV), and a Magnavox RD0510 5" portable color TV with direct video input (luma or CV interface). The Apple monochrome monitor of course gave the cleanest display: crystal-clear and razor-sharp using the CV Disable switch. Performance among the various color displays varied tremendously. The Commodore monitors, with their fine dot-pitch, gave the sharpest color images, while I judged the Magnavox 1CM135 slightly less sharp than the Commodores. The coarse dot-pitch on the Amdek rendered poor resolution, but color saturation on the Amdek is superb even with the pallid color output of the upgraded 600XL and 800XL. Performance on the little Magnavox TV didn't compare to the monitors due to the tiny screen and really coarse dot-pitch. You could run color games on it for demo purposes. Using only the luma output and turning off the color controls, you could do 40-column AtariWriter wordprocessing on it if you don't mind the tiny letters.

## Coda

While I was writing up this article a long-awaited 1450XL finally arrived. With considerable excitement I connected it to my test monitors and fired it up. Horrors!! The display was as bad as a stock 1200XL! With no schematics, board diagrams, or manuals of any kind, and an opaque circuit board that you can't follow traces on by holding it up to strong light (the 1450XL employs a multilayered board), reverse-engineering the video circuits is a formidable task. I took time away from this article to hack it. I only got bits and pieces, but that was enough. The mono circuit has a 390-ohm output impedance (groan!), and there's a capacitor sucking away all the high-frequency response from the mono output, the mono output is full of color clocking trash, I can't find the chroma... sheesh! The long arm of the Sunnyvale Butchers reached out to poison even the products that never made it to market.

Thanks for the tainted legacy, Atari.

# Swap 'N' Shop

## A Flea Market For All Atari 8-Bit Users!

**WANTED:** Marble Madness for the 8-bit Atari. Roger Cole, 911 Devon Drive, Newark DE 19711. Internet: roger.cole@ mvs.udel.edu.

**8-BIT SOFTWARE:** Over 1500 game titles alone. Virtually every program made for the Atari 8-bit. Send $1 for double-sided enhanced-density disk inventory. Tampa Computer Orphans, 3530 Del Lago Circle #238, Tampa FL 33614 USA.

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**I HAVE THE FOLLOWING** equipment for sale: working 1050's $35 (nonworking 1050's $15); XF551's: $70; 13" NTSC analog color monitors (Amdek 300 & Commodore 1802, both have luma-chroma & composite video inputs), $65; 410 tape drives, $12; 800, $20; 600XL, $20; 800XL, $30; 65XE, $30. All equipment comes with power supplies & cables. I occasionally get 850's ($25), 130XE's ($75), & XMM801 printers ($75): call for availability. Extra power supplies, $5-$10. Al equipment is used in GC to EC depending upon equipment type. I still have some EIKI & B&H 16mm sound projectors for $50-$150 depending on brand/model (25% less than store prices in used condition). UPS shipping cost depends on pkg wt & zip code, call for info. David Aronson, 2911 Bree Hill Road, Oakton VA 22124. 703-620-6183 evenings/weekends.

**JUST DEVELOPED!** AW+ & AW80 RAMboot disks for 256K & 1-meg. Go back & forth from AW to MyDOS instantly without losing text. Full instruction file on Side 2, plus MyDOS write file for 64K/128K. Disk with boot instructions $25, specify 256K or 1-meg, AW+ or AW80. WANTED: XEP80 80-column module; Macro Assembler. Brad Rand, 255 Falmouth Road, Falmouth ME 04105-2005. 207-781-4877.

# TTL Video For The Classic Atari

## by Bob Woolley, AC Staff Reviewer

### Which Monitor?

One of the issues confronting users of classic Atari computers today is the selection of a suitable monitor for your system. Unfortunately, no one display will provide optimum performance under all conditions. A color monitor, for example, builds a pixel out of triads of red, blue and green dots. This produces a pleasing display when viewed at a distance, but quickly becomes grainy and indistinct as you get within a few feet of the screen. A monochrome monitor doesn't have the color screen's resolution problem, but graphics lose much of their personality when displayed as shades of a single color. The newer VGA monitors have much smaller color triads which give them both unlimited color and high resolution, but they run at much too high a frequency to be used on our classic 8-bits. So, we have to compromise: text clarity or color graphics?

If most of your time (like mine) is spent in text modes, a monochrome monitor is really your best alternative. A good television with direct video inputs will fill in for those occasional games and demos, while the bulk of your computing (programming, word processing, telecommunicating, etc.) can be done on a nice sharp monochrome screen. Sadly, the supply of high quality analog displays is very limited since most computers (read: IBM) are now built with TTL (digital) interfaces. (See "Super Video 2.1XL" elsewhere in this issue for a more general discussion of video interfaces.)

Unmodified, the Atari requires an analog NTSC or PAL composite monochrome monitor which are practically impossible to find any more. All you see for sale are these days are TTL units (and even those aren't quite as popular as they were a few years ago). What we need is a way to interface our Atari to a TTL monochrome monitor that we can use for text displays while keeping our composite output for color graphics. That's the subject of this upgrade.

### TTL Caveats

By adding my circuit to your 8-bit, you'll be able to run two separate monitors on your Atari: the normal composite sources and a 9-pin TTL device. I've used the TTL interface to drive both color IBM CGA (Color Graphics Adapter) monitors as well as monochrome IBM MDA (Monochrome Display Adapter) displays, although the wiring needs to be modified for each type.

Why use a CGA display? Well, the MDA interface only has the capability to display four levels of gray, where our Atari will normally output eight. This isn't much of a problem in most text modes, but does leave a few holes in graphics. PacMan, for example, loses two of its ghosts in the background when run on an MDA display. On the CGA monitor, we can display all eight intensity levels, each as a different color rather than shade. Text still suffers from the pixel size, but it does make a very clear and colorful alternative to MDA. Keep that in mind when you plan your configuration. Otherwise, the text on a TTL monitor is razor sharp and much easier on the eyes than any color monitor.

Another concern is the frequency difference between the 8-bit and an IBM. Horizontal sync frequency on a standard MDA monitor is 18kHz, while the Atari runs at 15.75kHz. To check for problems in this area, I tested a number of MDA displays on the upgrade. Most ran just fine, with some needing slight horizontal or vertical frequency adjustments. Making these adjustments can be significant if you're using a monitor like the IBM 5151. This model has no external controls! I had to remove the cover (no simple task) and adjust the pots inside the cover. Another negative for the IBM 5151 is the slow P39 phosphors used on the screen. This long persistence surface causes a smeared image as an object is moved or scrolled. I can't recommend the IBM, although it does work with the interface. I suggest a good amber screen with a high contrast filter like the Amdek 310A or Samsung SM-12SFA7. These monitors provide an excellent text display and are widely available.

### Doing The Mod

The construction method I used on this project allows you to build the board and simply plug it into your computer: no wires need to be soldered to your motherboard. I prefer this technique since it makes it easy to remove the modification in case of a problem, and it allows a friend to build you a board without your system being out of service.

I used half of a small Radio Shack perfboard (#276-148) and 30 gauge wirewrap wire to mount the components. Sockets are optional but recommended. You'll have to remove the 4050 video buffer from its socket on your motherboard. If it's not socketed, cut it off the board and add a socket.

I used .018 diameter standoff header pin connectors to plug into the vacant 4050 socket. *[These type headers are hard to find but are used in the Wizztronics 256K RAM upgrade and are available from Best Electronics. -BP]* This provides us with all the necessary signals and power. See Fig. 1.

The output cable is a short length of nine conductor ribbon cable with an IDC female DB-9 connector on one end and a ten pin dual row header-pin connector on the end that connects to the board. I mounted the DB-9 connector on the case of my 1200XL, but you can just run it out through the case seam if you like and let it hang free. The installed TTL board and cable are shown in Fig. 2.

Refer to Fig. 3 and the table below for a pinout description of a typical TTL monitor:

| Pin # | Signal |
|---|---|
| 1 | GND |
| 2 | GND |
| 3 | Red (1) |
| 4 | Green (1) |
| 5 | Blue (1) |
| 6 | Intensity |
| 7 | Video |
| 8 | H-Sync |
| 9 | V-Sync |

Note (1): these pins not used in MDA (monochrome) monitors.

Take note of the two designations for pin 8 of the DB-9. One is for a CGA monitor, and the other is for an MDA monitor. These monitors use different sync polarities and may or may not work with the wrong polarity. *[A few brands of monitors have a switch in the back for positive or negative sync. The enterprising hacker might elect to install a switch here if your monitor lacks one. -BP]* Choose CGA or MDA when you wire up the board (or install a switch). It

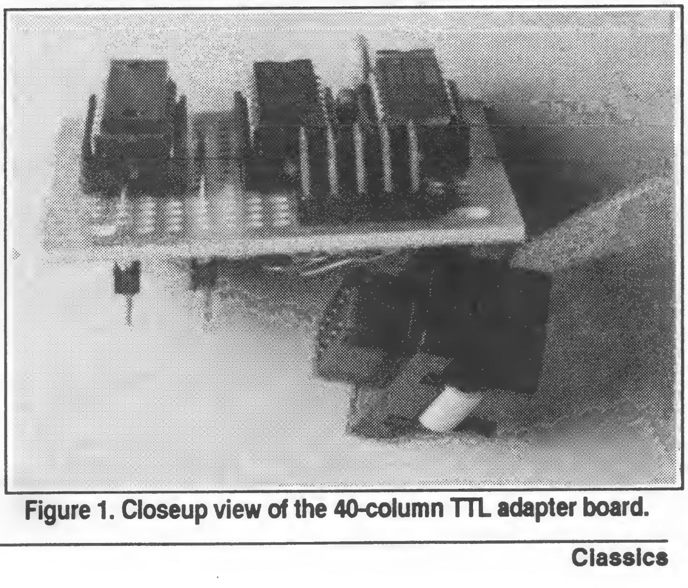

**Figure 1. Closeup view of the 40-column TTL adapter board.**

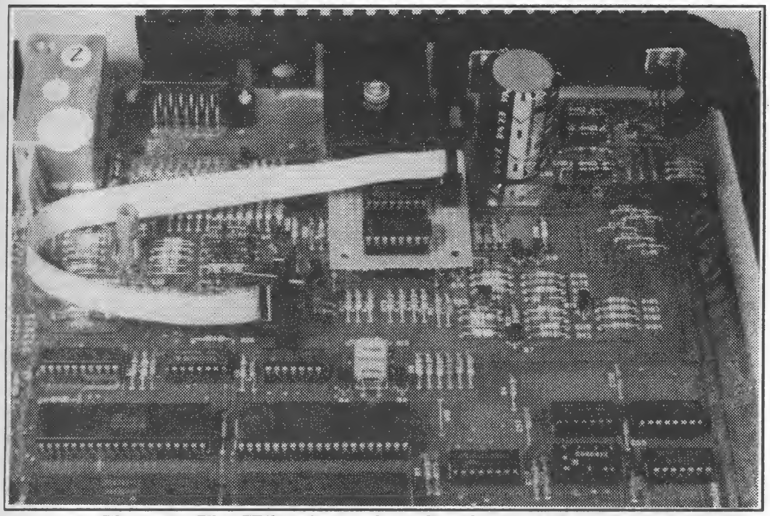

Figure 2. The TTL adapter installed in a 1200XL.

won't hurt anything if you use the wrong polarity; your monitor just won't have a stable display.

I laid out the schematic diagram (Fig. 4) with all the inputs on the left (from the 4050 signals on your Atari motherboard) and all the outputs on the right (through the ribbon cable to the DB9 connector). Not all models of classic Ataris use the same sections of the 4050 IC for the corresponding signals. The 4050 inputs are labelled LUM0, LUM1, LUM2, LUM3, and CSYNC. Corresponding pins on the 4050 in your particular model are as follows:

| MODEL | LUM0 | LUM1 | LUM2 | LUM3 | CSYNC |
|---|---|---|---|---|---|
| 130XE | 7 | 11 | 5 | 3 | 14 |
| 800XL | 7 | 11 | 5 | 3 | 14 |
| 600XL | 9 | 7 | 11 | 5 | 14 |
| 1200XL | 3 | 9 | 7 | 5 | 11 |
| 800 | 5 | 9 | 14 | 11 | 7 |

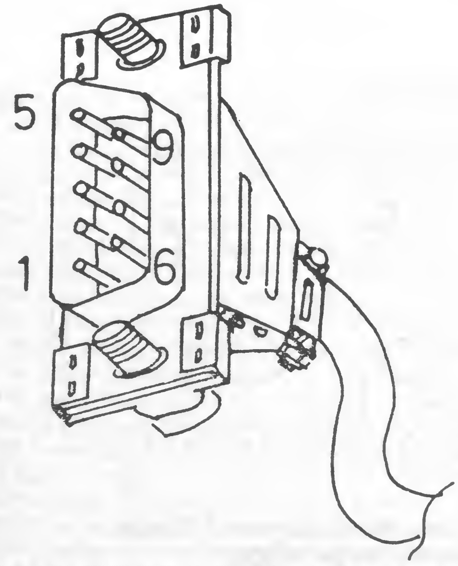


Figure 3. Signal pinout on a CGA monitor connector (DB-9 connector on cable coming out of the monitor).

A final word about parts. You can substitute a standard CD4050 noninverting hex buffer for the 74HC4050 I used; the pin numbering is the same, and the CD4050 is readily available at Radio Shack. You can also substitute a standard CD4001 quad two-input NAND gate (also available at Radio Shack) but be careful! The 4001 has a different pinout than the 74HC02 shown in the diagram. Refer to Fig. 5 for the pin description of the CD4001. As long as you stay with CMOS gates this project should work all right. DO NOT USE STANDARD TTL OR LS-TTL TYPE LOGIC CHIPS!! They may not work at all, or performance may suffer in unpredictable ways.

Also, the IDC crimp-on style DB-9 connector isn't available at Radio Shack, though many mailorder parts houses such as Jameco or Digi-Key sell them. If you elect to mount the DB-9 connector on the rear of your machine, a panel-mount type is available at Radio Shack (#276-1538).

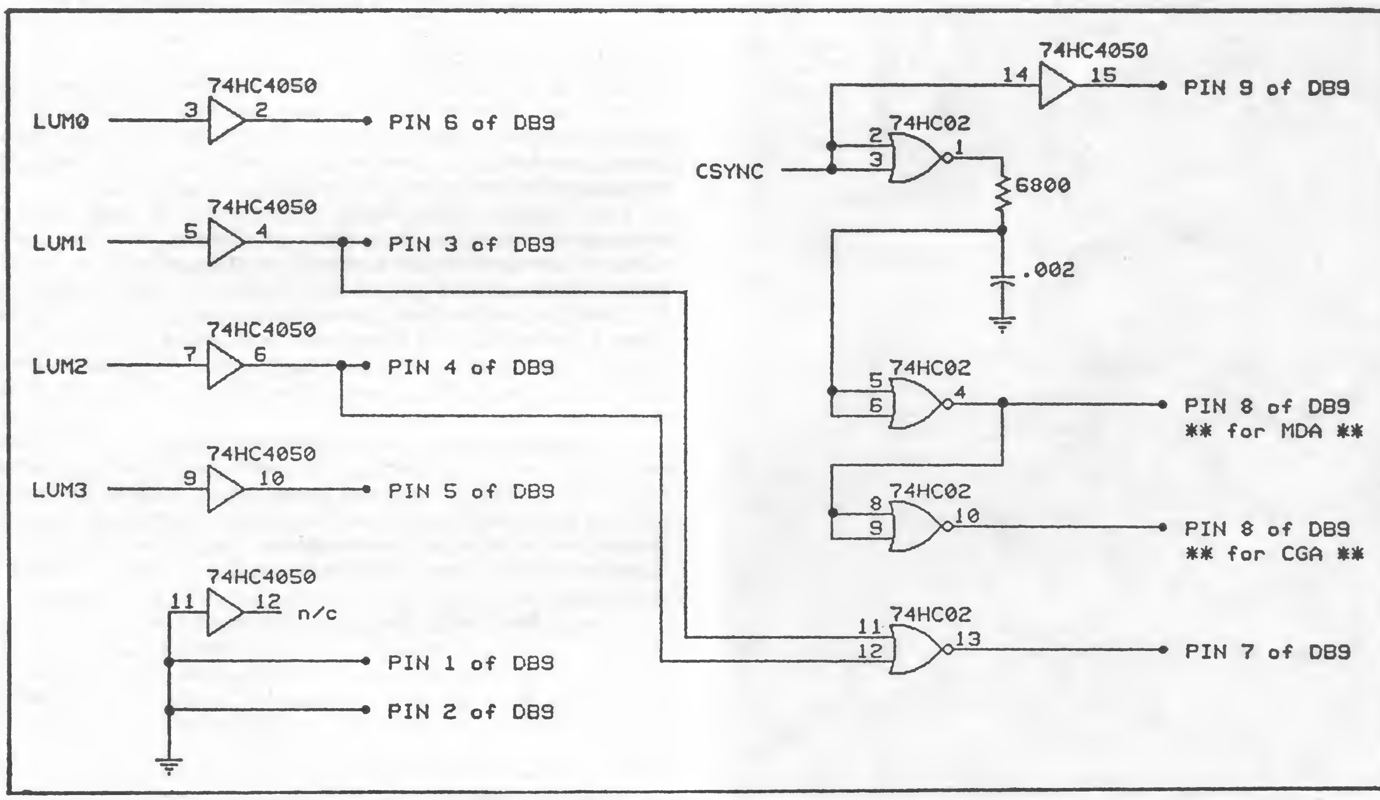


Figure 4. Schematic diagram of the MDA/CGA TTL interface for classic Atari 8-bits.

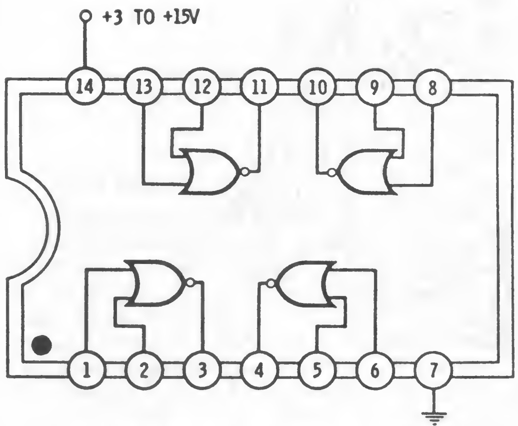


**Figure 5. Pinout diagram of CD4001 substitute for the 74HC02.**

## Only Half The Job

You can wire-wrap all the connections on the underside of the plug-in board as seen in Fig. 1. After everything is installed and hooked up, you might see some tearing or screen rolling on your TTL monitor when you boot up the computer. Adjust the monitor controls for a clear, stable display. I think you'll be impressed with how crisp it looks on an MDA monitor. Your usual composite video signals are still available at the rear output jack on your 8-bit if you care to compare the analog and TTL displays. It might be interesting to do an A/B test of Ben Poehland's Super Video 2.1XL or Charles Cole's XE analog upgrades to my TTL upgrade!

High-quality 80-column monochrome text has been available for the classic Atari for about six years now, and many of you who purchased them were no doubt impressed by the sharp display these units produce. But, you still need a hard-to-find analog composite monitor to enjoy the 80-column text. If you perform the 40-column TTL upgrade I've just described, and you have an XEP80 in your system, you end up needing two monitors: TTL for the 40-column output, and composite for your XEP80. So, at this point the job is only half done. Wouldn't it be nice if the XEP80 could also be modified for TTL video? Read on!

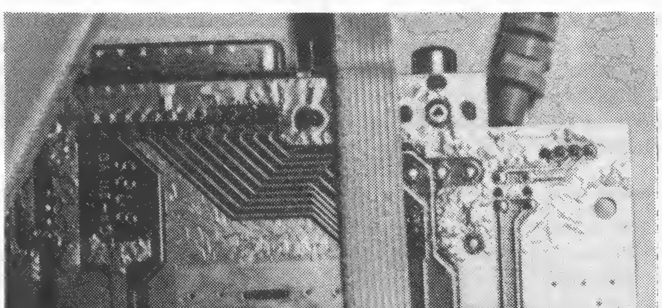

**Figure 6. Orientation of ribbon cable for XEP80 TTL modification.**

## XEP80 Vs. Composite Video

The XEP80 is a nice addition to your classic Atari. The characters are well formed and crisp with none of the video problems you often get with an unmodified 8-bit. Unfortunately, once you decide to upgrade your system to an 80 column display using an XEP80, you have a problem. The XEP80 is designed to be used on a composite monochrome display, but most composite monitors these days are used in video applications (i.e., closed-circuit TV, security monitors in shopping malls, etc.), not computer data. This is a problem since a video frame is designed to overscan the edge of the screen while data frames aren't. This could run some of your data off the edge of the screen where you can't see it. (This is why our E: editor starts its text in column 2 instead of 0).

Coupled with the fact that video monitors have poor linearity and bandwidth, you'll probably be disappointed in the performance of your XEP80 on a monitor not designed as a computer display. It'll work, but not well. The solution is to use a high quality TTL monitor with your XEP80. They are easier to find at a reasonable price, have very high (18MHz) bandwidth, and come in easy-to-read amber, green, or paperwhite shades. Fortunately, the modification required to make your XEP80 work on a monochrome TTL MDA monitor is both cheap and easy.

TTL displays require separate horizontal and vertical sync lines and a digital data line to create the video image. These signals are all available in the XEP80 without adding any circuitry: all we need to do is wire in a cable! I used a 12-inch, nine conductor ribbon cable and a female IDC DB-9 connector. This cable runs from the bottom of the XEP80 board, under the shields and out through the back of the case where it hangs free. The modification doesn't affect the operation of your regular composite output and only takes about an hour to perform (once you've gathered all the parts, that is!).

## TTL For The XEP80

Let's do the mod! Start by removing the four screws from the bottom case. Remove the lower case half and carefully pry the joystick cable retainer from the upper cover. Now you can remove the circuit board entirely. Remove the shields by straightening the six retaining tabs (make note of the shield orientation first).

Cut a length of 9-conductor ribbon cable 12" long. At one end, separate all the wires for a distance of about 2". One side of the cable will be marked with a colored (usually red) stripe. If the cable doesn't have a stripe on one side, make one with a marking pen. We'll use the mark to keep the cable properly oriented. Number the wires 1 through 9, with the marked wire being number 1. Now cut off the 2" free length of the following wires: 2, 5, 7, and 9. Strip 1/8" of insulation from the remaining five wires and "tin" the bare wire with solder. Set the cable aside temporarily.

Now examine the circuit board and locate the IC marked U6 near the edge of the board. Also locate the 220 ohm resistor just above U6 labeled R3 (red-red brown-gold). Orient the board and cable as shown in Figures 6 and 7, with the colored stripe on the left. Solder the flat cable to the positions on the foil side shown in Figure 7, and refer to the chart below to insure the wires are all going to the right places:

| DB-9 Pin # | Connection |
|---|---|
| 1 | U6,pin 7 |
| 2 | U6,pin 7 |
| 7 | left end of R3 (note) |
| 8 | U6,pin 9 |
| 9 | U6,pin 10 |

Note: this is the end closest to U6 pin 8.

When you crimp on the IDC connector, orient the cable so the colored stripe goes to pin 1, and the signals should automatically be

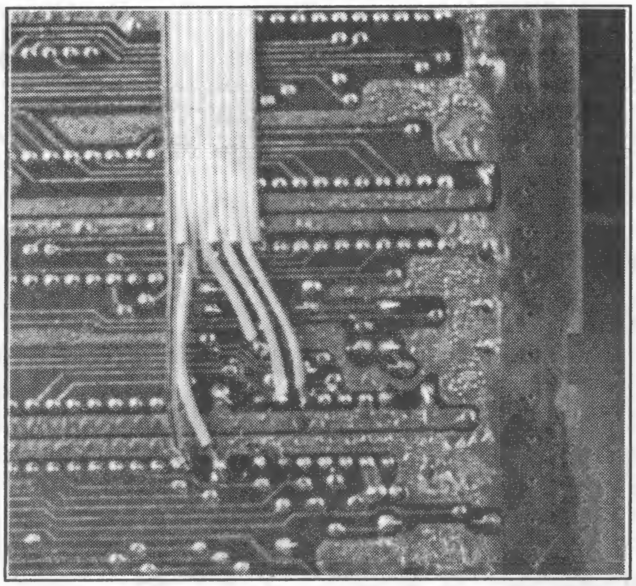

**Figure 7. Closeup of ribbon cable attachment for XEP80 TTL upgrade.**

routed correctly to the right pins. As noted in the 40-column TTL upgrade above, getting the IDC crimp-on type DB-9 connector might be a problem. You can use the panel-mount unit from Radio Shack mentioned earlier, but it's more work as you'll have to solder the signal wires to each pin individually. If you do it this way, be careful: it's very easy to get the pin order reversed! Also, you'll have to insulate the connector when you're done, preferably with heatshrink tubing from Radio Shack.

Now reassemble the shields and case in reverse order, and you're ready to go! As I mentioned earlier, you might have to make some adjustments to your monitor's horizontal or vertical controls, but all the monitors I tried would work after adjustment. If you made the TTL video modification to your computer as well, you can use a six pole, two position switch to select either 80 or 40 column mode, all on one monitor! Good luck!

*[Alchemist's Comment: I tested one of Bob's modified XEP80's extensively and was very favorably impressed. The monitors I used were: Arcus DM-14T 14" paperwhite, Princeton Graphics MAX-12 12" amber, Amdek 310A and 410A 12" amber, and an IBM 5151 12" green. Ordinarily I use a modified DEC Rainbow VR-201A 11" paperwhite, Heath/Zenith HVM-122A 12" Amber, or Apple A2M2010 12" green composite monochrome monitors with my XEP80. My eyesight is rather poor, so all my composite monitors are tweaked up for best possible linearity and focus: screen detail and resolution have always been more important to me than color.*

*On all the TTL monitors I had to do at least some H-sync, V-sync, V-size and focus tweaking to achieve a satisfactory display. The actual adjustments were straightforward, but as Bob mentioned, getting to the controls was in most instances a pain in the neck. At first I wondered why the manufacturers take such pains to hide these controls, but then I reminded myself that these monitors are made for the IBM market. The average IBM user isn't expected to know how to adjust his monitor and will be expected to pay some grinning service technician a fat fee to do what those of us with common sense can do for ourselves. On the other hand, anode voltages on mono monitors typically run 14,000 volts and color even higher: 25,000 volts; you can fry yourself to charcoal if you don't know what you're doing.*

*So, how does the Bob's TTL upgrade stack up to my well-tweaked composite monitors? It was a close race, as the analog and digital displays were both excellent. But Bob's TTL interface has the edge over the analog displays. I'll even go so far as to state that a TTL-modified XEP80 is absolutely the cleanest display you'll ever see from any classic Atari.*

*Among the various MDA monitors there was marked variation in performance. The Arcus was my favorite. The large screen size, VGA-looking paperwhite phosphor, and etched-surface antiglare flat screen made it a pure pleasure to use. There's even a neat inverse-video switch on the back. (On the down side, tweaking it for the XEP80 was a nasty chore.) I paid $112 + shipping for this monitor, which is a tad expensive for an MDA (most go for well under $100), but it was worth it. I got it from Altex Electronics (11342 IH35 North, San Antonio Texas 78233; 800-531-5369 orders or 210-655-8882 info). Incredibly, all the other monitors I tested were junkers I fished from the trash (in today's environment the attitude seems to be, "If it isn't VGA, throw it out!").*

*Among the 12" monitors the Princeton Graphics was the best performer. Due to the employment of a dynamic focusing circuit this monitor was razor-sharp even around the corners of the screen where static-focused units start getting fuzzy. The Princeton also employed the same type of etched-surface antiglare as the Arcus. It was rather big and klutzy, though, and its cosmetics resembled the IBM a little too closely for my taste.*

*The Amdek monitors are cheap, abundant,... and very popular. I don't know why. Sure, they're sharp and clear enough. But the antiglare treatment on the CRT surface, which consists of thousands of tiny lense-like carvings on the 310A and a kind of embedded thin-woven cloth on the 410A, creates a halo effect that squanders the advantage of the high resolution performance inherent in MDA displays. Worse, the textured surfaces on these units are easily scratched or abraded, which ruins the screen. Still, I see these things everywhere and most people seem not to mind. The analog version of the 310 employed the same weird type of antiglare treatment and was a always a favorite among Atari 8-bitters. Go figure.*

*The IBM was clearly the worst of the lot; Bob's negative commentary about it was altogether too kind. That awful long-duration phosphor revealed all sorts of annoying events that never appear on the fast-phosphor CRT's. Like, a line that appears down the center of the screen while the disk drive runs, and bright flashes of light that occur while Atariwriter-80 is loading. The phosphor takes a long time (14 years) to settle down after a screen rewrite. If you're into video masochism, hook up one of these to your system and play a videogame on it. But it does work, if you can stand it! - BP]*

# Exploring The Wild FONTier

by David Richardson
AC Staff Columnist

If you recall from my last article, I was explaining more of the DD3 formatting commands. Let's pick up where we left off, starting with the new page command.

## Starting Anew

DD3 allows you to start a new page by using the command \N. This command is like a page advance. This command is legal in a new line after a hard RETURN, before the first character to be printed as text on that line. Any text after this command will be on the next page.

The commands for the top and bottom margins are pretty simple. The command for the top margin is \XTnnn, and the command for the bottom margin is \XBnnn. In both cases, the "nnn" is a three digit number between 0 and 255. The value of "nnn" will give you a margin of nnn/72 inches. Both of these commands are legal in the first line of a file, before any characters to be printed on that line, or in any line containing the \N command, after the \N command, but before any characters to be printed on that line.

## I Need My Space

To adjust your line spacing, use the vertical spacing command \XVnn, where the "nn" is a value from 0 to 33, and it sets the value of the line spacing to nn/72 inches. This command is legal in a new line after a hard RETURN, or in the first line of a file, before the first character to be printed as text on that line. In order to print graphics, such as the picture of Winston Churchill in a previous article, I set the line spacing and character spacing (also mentioned in a previous article) both to zero. After the graphic is printed, I reset both the character spacing and line spacing back to their original values.

Here is an example of a graphic printed with the default spacing:

Here is the same graphic the way it is supposed to look, with vertical spacing and character spacing set at zero:

The graphic above was created using the font BIKINI.NLQ, which I created using some of the utilities that are available for DD3.

## From Head to Foot

DD3 allows you to have headers and footers. The command for defining the header is in the format:

\Hnntexttexttext[RETURN]

The command for the footer is:

\Hnntexttexttext[RETURN]

The [RETURN] at the end of the header or footer is part of the command and does not begin a new line in the document. The header will print nn/72 inches below the top of the page. The footer will be printed nn/72 inches below the top of the bottom margin. The text for the header and footer can be up to 80 characters. The header or footer text should include formatting commands for any feature that is changed somewhere in your document. Here is an excerpt from the DD3 documentation:

"For example, if character spacing is never changed within a document, there is no reason to include a resetting command in your header or footer. But, for example, if the left margin varies throughout your document, make sure that the header or footer text begins with a command to set the left margin. To turn off a header or footer, follow the nn with a [RETURN] only. A header or footer will only print if it will fit within the top or bottom margin.

Both commands are legal in the first line of a file before any characters to be printed on that line, or in any line containing a \N after the \N but before any characters to be printed on that line.

## Turning Over A New Leaf

The next command is the new page number command, **\X#nnn**, which gives a new page number to the current page. All subsequent pages are numbered based on this number. **nnn** can range from 1 to 255. This command is legal in the first line of a file, before any characters to be printed on that line, or in any line containing the **\N** command, after the **\N** command but before any characters to be printed on that line.

To go along with the new page command is the insert page command, **\#**. This command inserts the current page number into the header or footer. This command is legal inside the text of a header or a footer. The next command is the append file command, **\A[filename.ext]**, which is legal anywhere. You can put this command anywhere in a document to instruct DD3 to print the specified file after printing the current document. This feature allows you to split a large document into several files.

The final command is the comment command, ***.** It is legal anywhere. It acts like a REM statement. Any text after this command until the next [RETURN] will be ignored by DD3. Use this command for including comments within a document. That wraps it up for the commands of DD3. I hope that this gives you an idea as to how versatile it is. Now, let's move on to other things, such as more fonts.

The above picture was created with a font called LAUGH.NLQ. I first saw this picture in a local newspaper ad, and I thought it looked pretty neat. I created it by first using a digitizer called Computer Eyes, which digitizes only in black and white or shades of grey. I then loaded the picture into Micro-Painter to touch it up a bit and to add color. When I made it, I hadn't thought of making a font out of it, so when I decided to do so, I used a utility called GR8TODD3, which converts picture files to DD3 fonts.

Here is another made in the same manner:


The above was derived by digitizing a Farside cartoon, which is done by Gary Larson. The font is HENNYDOG.NLQ.

One thing most people may not know is that Print Shop icons can be converted to be compatible with DD3. Here are some examples:

This font is called HORO2.NLQ, and was created using a Print Shop conversion utility called PS2DD3. Each icon consists of three characters. I will get into how to do icons in the next column.

Until next time, keep on exploring the wild fontier.

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P.O. Box 746
Lawrence, KS 66044
(913) 843-5213

To get DD3, send $25 to:

Roy Goldman
2440 South Jasmine
Denver, CO 80222

# Super Video for the 130XE

## by Charles Cole, AC Hardware Editor

### An Idea Is Born

I was pretty impressed with Ben Poehland's "Super Video 2.0" articles in his final months at *Current Notes*. His in-depth analysis of the problems he found in the 800XL, and his explanations of why he made the changes he did, gave me some insights I never had before. The knowledge he passed on spurred my curiosity and at the same time filled me with the confidence that comes with an in-depth understanding of any problem.

I'm an aficionado of the XE, and I was frustrated that The Alchemist's video upgrade only dealt with the 800XL. In his work he only briefly mentioned how defects in the XE's video output were similar to, and in some ways derived from, the problems Atari designed into the XL series. This only whetted my appetite. I could see the grainy background on my XE display that Ben described, and in addition I had never been happy with the XE's weak color performance—which The Alchemist didn't discuss at all. With so much groundwork laid by The Alchemist, I found the urge to apply his ideas and principles to the XE irresistable. The idea that an XL owner should have a machine that produced better video than my XE was, well, a matter of dignity.

I didn't have any hardware documentation for my XE. This was a problem. You just can't go tearing into computers without the docs. I've noticed The Alchemist in his articles seems to draw heavily upon hardware information he's collected in his travels, he must have a ton of Atari hardware manuals. *[Yup. Two tons, actually. Bought, begged, borrowed, and stolen. And they're mine! All mine!! Hah! - Alchemist]* So the first thing to do was get the Sams *ComputerFacts* for the 130XE. I purchased it from Best Electronics.

### Butchers—Or Bunglers?

With the *ComputerFacts* diagrams in hand, I opened up my 130XE and started looking at the XE video circuits. I started with the monochrome video amp Q3 first, since Ben had indicated this to be a source of video problems in the XE. The first thing I noticed was that Atari had again used the same incorrect 100-ohm value of output impedance (R53 in Figure 1) as they designed into the XLs. At the same time, they made another change in an apparent attempt to fix it: they lowered the value of the series output resistor from 75 ohms (which was correct in the XL design) to 47 ohms.

It's important to understand that R53 sets the output impedance, while R204 determines the series or "reflected" impedance (the impedance the monitor input "sees" looking back at the computer). This series resistance also protects the transistor by ensuring a load on the output under worst-case conditions, such as a short-circuit across the output. Having set the output impedance 25 ohms too high, Atari "fixed" it by setting the series impedance 28 ohms too low. This is weird, and it doesn't really fix anything: the only thing Atari accomplished here was to mangle the overall impedance of the circuit. In my communications with Ben he occasionally mentioned that Atari didn't understand video signals very well. Now I understood what he meant. If you want independent confirmation that the old Alchemist was onto something, this is it. It also shows that Atari realized there were problems here and made a slapstick effort to homogenize the mess.

Atari also repeated another design error in the XE monochrome amp they had made in the XL: Q3 is "starved" for current because the value of R116 is too high. I made a note of it, but it didn't worry me much. The Alchemist already had shown how to cure that in the 800XL.

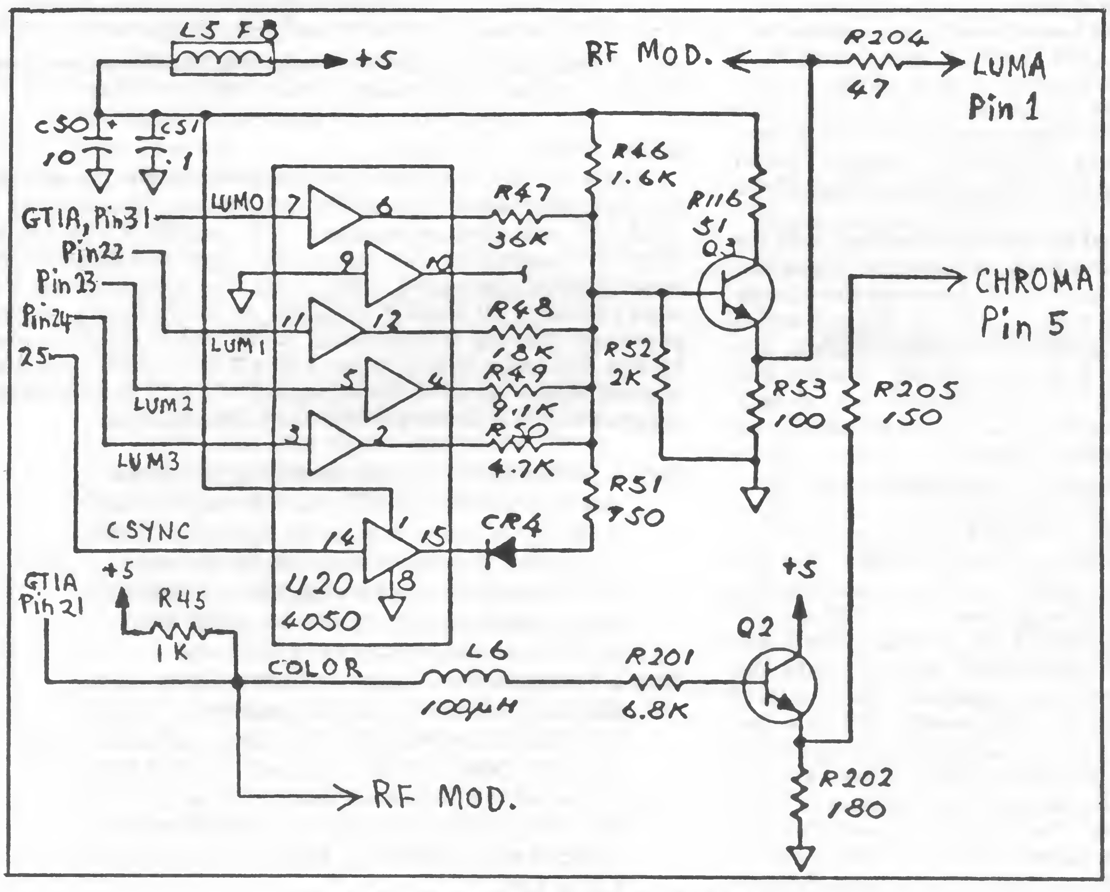
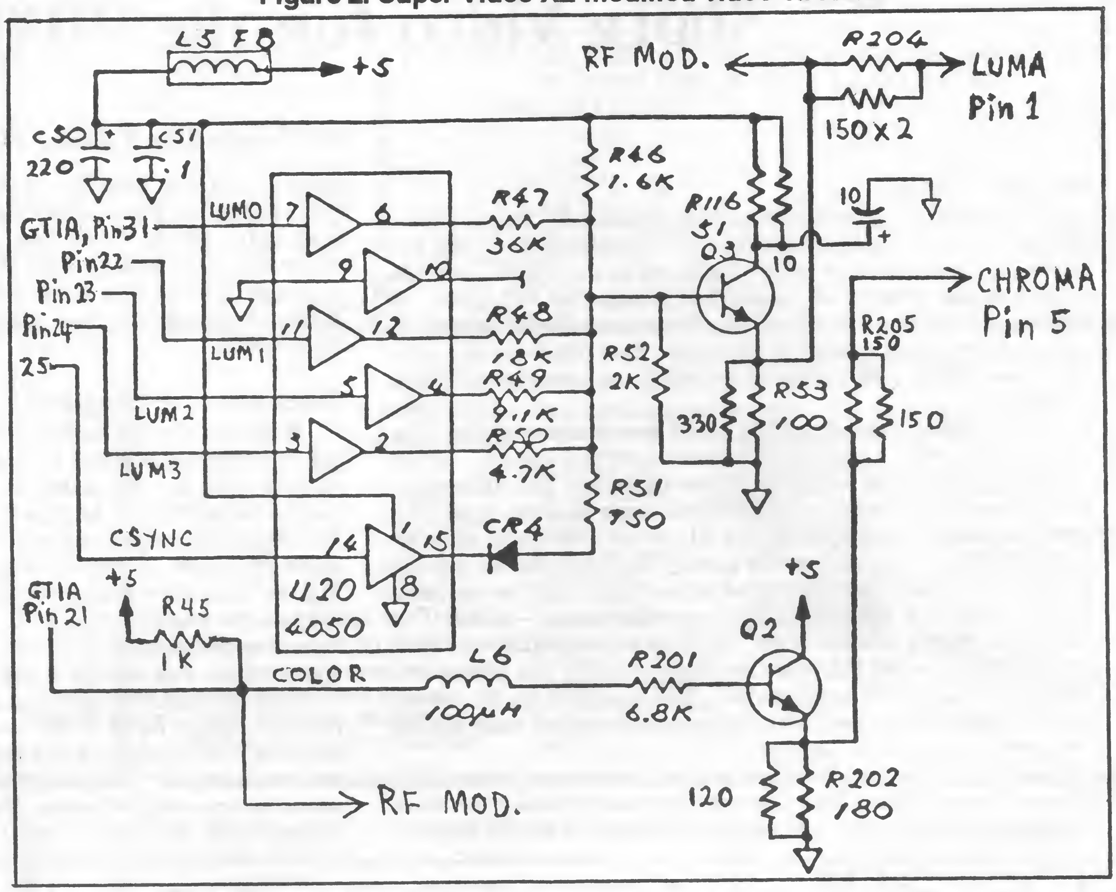



**Figure 1. Stock 130XE video circuits.**

Figure 2. Super Video XE modified video circuits.




## Color By The Keystone Kops

Next I looked at the color circuit in my XE. This was territory not previously explored by Ben, so I was on my own here. Fortunately my task was made easier by the fact that Atari greatly simplified the color output circuits in the XE. Instead of the XL's three transistors, in the XE there's only one: Q2 in Fig. 1. The sole function of this lone transistor is to bring out the chrominance signal to pin 5 of the output jack, and the circuit is fairly simple.

Even so, Atari botched it. Same old problem: output impedance. Having erred on the side of too-low impedance in the monochrome circuit, here they made the impedances way too high, so the color output signal is effectively attenuated. That's why luma-chroma color displays on the XE have that bleached-out look. Resistors R202 and R205 (180 ohms and 150 ohms respectively) need to both be reduced to 75 ohms to achieve a strong color output signal. One can only wonder what was in the minds of Atari's designers when these circuits were laid out. A Hollywood comedy team could have done just as well. Which team might it have been? Laurel and Hardy? Abbott and Costello? The Three Stooges? Or maybe, the Keystone Kops?

At this point I encountered an evil little problem with my Sams diagrams: there's an error in the schematics! If you buy the Sams *ComputerFacts* for the 130XE, be aware the pinouts on the video jack are incorrectly labelled. Pins 1 and 3 (luminance and audio) are correctly labelled, and pin 2 is shown connected to ground: these are all OK. But pin 5 is shown in the Sams diagrams as Composite Video, when it should be labelled Chrominance. And pin 4, which has no label at all, should be labelled Composite Video. Maybe there's a comedy team at Sams, too? Well, I'm not laughing.

A final comment on the XE video design before we start fixing up things: in the diagrams the RF modulator is shown as a "black box", with no indication of what's inside. Yet, the RF modulator in the XE plays a more significant role than the one in the XL machines. Not only does it provide the RF output to the antenna terminals for a TV interface, but it also contains the channel selector switch and outputs the composite video signal to pin 4 of the video jack. That's a lot of functions assigned to one "mystery component". If it fails, you lose two of your video interfaces at once (composite video and TV). What happens if it does fail- can you fix it? Not likely! If you pry off the top of this little box and look inside, you'll see why. There isn't much to see. The innards consist of a little circuit board crammed with microminiature surface-mount components. If it fails, desolder the whole box and throw it away, then buy a new one from Best. You can't even *see* these things, much less repair them.

## Super Video XE Mods

Parts for this upgrade are simpler than for the corresponding upgrades on the XL machines. You'll need a 10uF/16V tantalum capacitor, a 100- or 220uF/16V radial electrolytic capacitor (the larger value is preferred if it's the same physical size as the 100uF unit), and some common 1/4-watt resistors, all readily available at Radio Shack. If you purchased the bag of resistors at Radio Shack recommended by The Alchemist in his "Super Video 2.1XL" article you'll be in great shape. Refer to the schematic of Fig. 2 and the board diagram of Fig. 3 as you perform the following steps.

**Step 1.** Locate R116, a 51-ohm resistor (green-brown-black-gold) on the 130XE motherboard (it's fourth in the line of components to the right of the color tuning pot). Select a 10-ohm resistor (brown-black-black-gold), trim the leads to an appropriate length, and solder this resistor in parallel with R116 on the component side of the board.

**Step 2.** Locate the video output transistor Q3; the flat side faces left, and the lead connections are at the top, left side, and bottom. The bottom lead is the collector. Select a 10uF tanatalum capacitor and trim its leads to an appropriate length (no more than 1/2"). Solder the (+) end of the cap to the collector of Q3, and the (-) lead to the top of either C47 or C48.

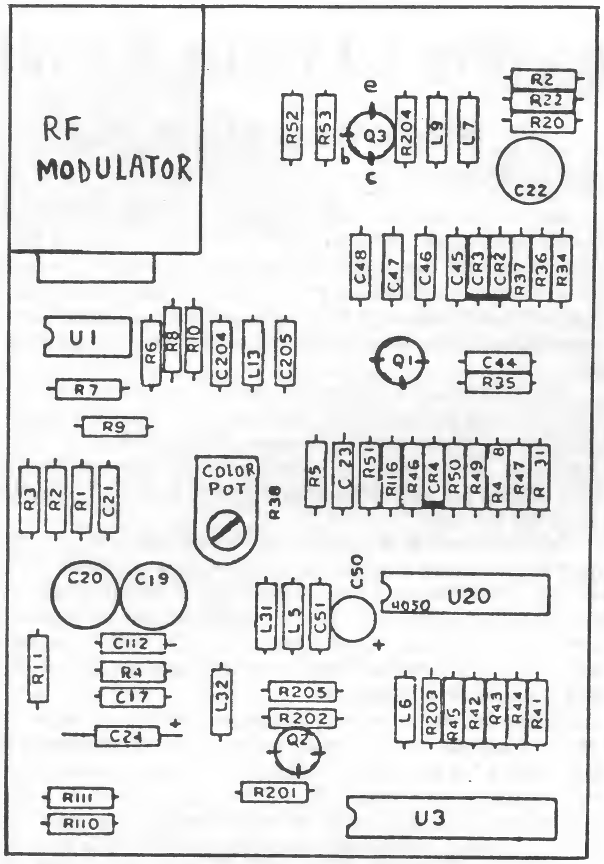



**Figure 3. 130XE parts placement diagram.**

**Step 3.** Locate the 100-ohm resistor R53 (brown-black-brown-gold) just to the left of Q3. Select a 330-ohm resistor (orange-orange-brown-gold), trim the leads to an appropriate length, and solder this resistor in parallel with R53 on the component side of the board.

**Step 4.** Locate the 47-ohm resistor R205 (yellow-violet-black-gold) just to the right of Q3. Remove this resistor from the board and clear the board holes of solder. Twist two 150-ohm resistors (brown-green-bown-gold) together in parallel and solder this "compound resistor" in the space vacated by R205.

**Step 5.** Locate the 180-ohm resistor R202 (brown-grey-brown-gold) just above the color output transistor Q3. Select a 120-ohm resistor (brown-red-brown-gold), trim its leads to an appropriate length, and solder it in parallel with R202 on the component side of the board.

**Step 6.** Locate the 150-ohm resistor R205 (brown-green-brown-gold) right above the R202 you just modified. Select a 150-ohm resistor (brown-green-brown-gold), trim its leads to suitable length, then solder this resistor in parallel with R205 on the component side of the board.

**Step 7.** Locate the 10uF electrolytic cap C50, just to the left of the 4050 buffer U20. Desolder it and clear the board holes of solder. Install the 100uF or 220uF radial-lead electrolytic cap in place of C50, taking care to orient the leads so the (+) lead faces the bottom of the board in alignment with the "+" symbol screened on the board. That's it, you're done!

## Simply Better

The results I obtained were so dramatic that I found it necessary to readjust the 130XE's color tuning pot and my monitors's color intensity controls. Using the luma-chroma interface on my Zenith ZVM-130 color monitor, the colors are now much stronger and more brilliant. If you're using the 130XE for any color applications, you need this upgrade!

*[Alchemist's Comment: after reviewing Charles' work on the 130XE, I now regret not having examined the XE- especially the color circuit- before proceeding with my S-V 2.1XL upgrade. In my mind's eye, I now perceive a final video upgrade, Super Video 3.0, that holds the promise of combining the best features of the XL and XE color circuits while eliminating the last vestige of color ghosting that still plagues even S-V 2.1-upgraded XL machines. In my conception, S-V 3.0 would be a third-generation upgrade you would apply to ANY classic 8-bit, be it an 800, XL, or XE. It would consist of the simplified color circuit of the XE combined with the saturation boost circuit from the 1200XL, plus the upgraded monochrome amp described in both mine and Charles Cole's articles. That would be the theoretical goal of this final round of video research.*

*So, will there ever be a Super Video 3.0? Don't count on it. Not from The 8-Bit Alchemist, anyway. I'm entirely happy with S-V2.1XL on my XL machines, and the XL is what I use most. I use my 130XE only occasionally, and never with a color monitor (for a variety of reasons I just never developed the emotional attachment to the XE that I did for the XL). With this issue of AC I'm now satisfied that the subject of video upgrades has been raked over about as well as can be without entering the domain of diminishing returns. There are other aspects of classic Atari hardware that beckon the attention of The Alchemist, and I also feel that Bob Woolley's TTL upgrade offers users a far easier alternative to video Nirvana than spending the considerable resources it would take to develop S-V 3.0. -BP]*

# Color Tuning Utility for the Classic Atari

## by Jeff Potter, AC Graphics Editor

### Screen Of Many Colors

Your Atari 8-bit computer with its GTIA chip (Graphics Television Interface Adapter, part of the custom 40-pin chipset found in all models of Atari 8-bits) can produce an amazing array of 256 colors on a composite color monitor or color television set. However, this is only true if your computer's color output has been properly adjusted. Poorly tuned computers might not produce certain colors, or might generate the same color from two different SETCOLOR commands—which means you'll miss other colors elsewhere in the spectrum.

In my quest for information on the Atari computer, I could never find a good procedure describing how to properly align the color. There's nothing about it in the Atari service manuals, and the Sams *COMPUTERFACTS* manuals only say, "...adjust the Color Control...for a blue screen...". If you've ever tried this adjustment you'll observe your screen passing through a variety of different shades of blue (and other colors) as you turn the control. Which BASIC blue is the right blue? Realizing that no two people see blue the same, I came up with my own procedure for adjusting the color that doesn't rely entirely on arbitrary choices.

### Hey Man, Where's Your Pot?

All 8-bit Ataris have a color tuning pot (potentiometer, or variable resistor) which you can safely adjust without opening the case. On the 800 it's located along the back side, about 3 1/4" from the left side along the seam between the ribbed top cover and the main body. On the 600XL and 800XL it's located on the bottom of the case, at a point directly beneath the left SHIFT key. For you 1200XL owners, it's the hole just beneath the serial number label on the bottom of the case, positioned between the 6 and 7 number keys on the keyboard. If you own the very rare 1450XL, you'll have to open the case and look for the pot on the lower right side of the board (Atari placed the tuning access hole in the same position as it is on the 1200XL, but the board location doesn't match!). On the 130XE you'll also find it on the bottom of the case, but more near the center (directly beneath a point one inch above the "3" key and about two inches to the right of the "ATARI" label).

In all instances, you'll see a hole not plugged by a phillips head screw or a black rubber foot. You should be able to fit a very narrow (5/64" or so) flat screwdriver blade into this hole to engage the slot in the tuning control. But... don't go fiddling with it just yet!

### A Little BASIC First

Boot up your computer with BASIC installed. Type in SETCOLOR 1,0,0 to get black characters, then type SETCOLOR 2,1,10. Adjust your color TV or monitor to produce a clean, bright yellow (about the color of a number 2 pencil) using the HUE or TINT controls. This is the same color my APACVIEW program creates as a reference background. It shouldn't be too orange, or show any tint of green. Now type in the following BASIC program:

```
4 REM COLRTUNE BY JEFF POTTER
5 REM ATARI CLASSICS COLOR TUNING
6 REM UTILITY: ADJUST POT UNTIL
7 REM BEST TRANSITION BETWEEN GREEN
8 REM AND ORANGE OCCURS IN CENTER
9 REM OF SCREEN.
10 GRAPHICS 11:N=8
20 FOR K=0 TO 79
30 N=N+0.2
40 IF N>15.99 THEN N=1
50 COLOR INT(N)
60 PLOT K,0:DRAWTO K,191
70 NEXT K
80 GOTO 80
```

### Using COLRTUNE

As always, save a copy to disk, then type RUN. COLRTUNE should draw a bar pattern of all 15 colors available from the GTIA chip (except for black which has intentionally been skipped). Just left of center should be a rather sick orange-green color, and just right of center should be a rather pure orange. Now insert the screwdriver in the tuning pot you located earlier, and adjust it carefully.

You should try to match the color just left of center so that it is just a tiny bit greener than the color just right of center. When perfectly tuned, the screen will be a continuum of colors, with no abrupt change at the center, no missing colors, and no duplicate colors. Your tuning pot only goes once around, so don't try to turn it too far left or too far right.

On some Ataris, a metal screwdriver detunes the color circuit, so don't try to make a decision on the colors with the screwdriver inserted. Even though you're poking into your Atari with a metal screwdriver, you stand very little chance of getting shocked: only very low voltages (+5 volts) exist inside your computer. (This is about what three fresh flashlight batteries in series generates and isn't considered dangerous.)

If you follow these simple instructions, your Atari will produce all the colors and hues it was designed for. Keep the program handy and "tweak" it up periodically, as the setting will tend to drift as your machine gets older. If you're interested in details on how the color adjust circuit in your computer works, see Ben Poehland's article "Color And The Clock" immediately after this one. Good luck!

*[Editor's Note: Several of the Editors tried Jeff's COLRTUNE and found it effective and easy to use. We'll include it on the February '94 AC Software Disk, although this program is so short we think most of you will want to just go ahead and type it in. -BP]*

# The Garret

## League Organiser

### Ed Hall, AC Staff Columnist

### Bloodthirsty Sport

You probably know that Canada has socialized healthcare, but did you know that Canada also has socialized hockey? It's true. The government provides free skates to everyone over the age of three, and all citizens are required by law to play hockey. *[Yeah, uh-huh. And Jack Tramiel hands out free computers on the street every Friday at 2PM. —Editor]* Each town has at least one rink and a bewildering number of hockey leagues: Atom, Mite, Peewee, Bantam, Midget, Juvenile, Junior (Tier 1 and Tier 2), Senior, Recreation, Commercial, and Oldtimer, to name just a few.

Our love for this bloodthirsty sport is closely linked to another national trait: a fierce, unbridled desire to be on time. Americans are brash, French are passionate, and Canadians are punctual. It all comes from our obsession with hockey: if you arrive late at the rink, you end up with less ice time. So why am I telling you all this? It's simple; these two Canadian characteristics are responsible for bringing you a new and invaluable piece of software. Here's how it happened.

### Beware The Blasters!

The team I play for is called the Ol' Blasters. (I live in a mining town, see.) One of our best players is a hardrock miner who works seven days a week, spends more time underground than above, and has the hardest shot on the team. Once, during a practice, he wound up and let a slapshot go from the point. The puck hit the goalpost and shattered into pieces!

Later, in the dressing room (after we had presented him with a bill for the puck), he uttered these fateful words: "Hey, when's the next game?"

"Next Friday," says Ernie, who's our league rep. "Same time."

"Not another 10:30 game! How come we get so many late games? Who made up this schedule, anyway?"

"It was Sid," replied Ernie, naming a guy who played for another team, the Rusty Blades.

"Oh, so *that's* why they get all the early games!"

Ernie shrugged. "Well, the league needed a schedule and no one else wanted to do it..."

### That Got Me Thinking...

First of all, how was the schedule made up? It wouldn't be a big job to do by hand, since there are only seven teams in our league, and eight weekly time slots. But the more I thought about it, the more I realized that it was a task eminently suited for a computer. I thought about the incredible variety of league sports played in every city across the continent, each one needing a schedule for regular season games, playoffs, and tournaments. Yet in each case only three sets of data were needed: number of teams, number of available time slots, and length of the season.

Doesn't sound too hard, does it? So how come I'd never come across such a program? The Atari Classic computer has been around for over a decade, and has built up an impressive library of software. Seems hard to believe no one had ever tackled such a useful project. I thought about it for a while, wondering if there were a database or a spreadsheet which could be recruited for the job. I even made a few rough notes towards an original program. Then I came to my senses and and sat down to write a letter to Les Ellingham, the editor and publisher of New Atari User. Les printed it in the Mailbag section of issue 55 (April/May 1992) under the heading, "Programming Challenge." In issue 63 (August/September 1993), he made an exciting announcement: the challenge had been accepted.

League Organiser by Adrian Hyland is an assembly-language program which comes on a double-sided disk. The instructions on side 2 are detailed, and accessed by a user-friendly menu. I immediately printed out a copy, skimmed through it, and then spent several hours with the program itself. I found it simple to use and capable of handling nearly all my scheduling needs. To my mind, League Organiser is an application which ranks right up there with spreadsheets and databases in terms of usefulness, because it can be employed for many other kinds of scheduling tasks, not just sporting events.

League Organiser creates round robin schedules (where each team plays every other team an equal number of times). It can accomodate a maximum of 31 teams and over 1500 time slots per year--more than enough for the average user. The program is divided into three main parts:

(a) enter teams
(b) enter dates & times
(c) display/print schedule

Each section is fairly compartmentalized; access is through a main menu, and controlled by the program. You can't enter dates and times until you've entered the teams, and once you've begun entering dates and times, teams can't be added or deleted. Nor can you produce a schedule unless you've entered enough time slots so that each team plays every other team at least once. This is an important point, since the number of games is predetermined by the number of teams.

### Editing The Season

Entering times and dates is the heart of the program. You begin by typing in the season's starting date, after which you are presented with a calendar. Move the cursor to the desired date and enter the game's starting time. If your game times aren't periodic, you'll have to enter each date and time individually. This could be a rather lengthy process, but there's just no other way to do it. However, if your game times are the same every week, then you can enter them on a weekly basis. For example, if you play at the same time every Monday, here's what you'd do:

- mark the starting date (CTRL M)
- go to the end date
- tell the program you want to enter a weekly time slot (CTRL W)
- open the time slot window (CTRL >)
- type in the game's starting time

This procedure automatically enters the starting time for all Monday games within the designated range. If there is another day of the week when you always play at the same time, you will have to go through this procedure again.

The program charts your progress in game multiples, the exact figure being dependent on the numbFi of teams. For example, if the display shows (a) 2x, (b) +5, and (c) -3, then:

(a) enough game times have been entered for each team to

play each other twice

(b) five additional game times have been entered

(c) three more game times must be entered to enable teams to play each other one more time

If you were to halt at this point, the last five game times (chronologically) would be ignored. If the display showed 0x, not enough times have been entered to produce a schedule.

Once all the dates and times have been entered, you go to the program's final section, where the completed schedule is displayed. If for any reason you're not satisfied, you can return to the previous module...but there is little point in doing so unless it's due to an oversight on your part (e.g. an incorrect entry). The program sets up its schedule according to the number of teams, and distributes each team's games evenly over the season. For example, in a league of six teams, each team would play once every three games.

| | | | | |
|---|---|---|---|---|
| 4 vs 5 | 3 vs 5 | 5 vs 6 | 1 vs 5 | 2 vs 5 |
| 3 vs 2 | 4 vs 6 | 1 vs 3 | 2 vs 6 | 1 vs 4 |
| 1 vs 6 | 1 vs 2 | 2 vs 4 | 3 vs 4 | 3 vs 6 |

The order in which the teams play each other is etched in silicon; it won't change from one season to the next, unless the number of teams (or the order in which they were keyed in) is changed.

## Post It On The Board

A scheduling program is useless without the ability to produce a hardcopy. League Organiser handles this task in a straightforward manner, with no need for special printer drivers. There are also a number of useful options, such as adjustable margins and line length. (North American users will have to change the number of lines per page to 66 from the default setting of 71.) One exceedingly nice feature is the ability to print out team (as opposed to league) schedules.

There are numerous other features which demonstrate the amount of care lavished on the program by Adrian Hyland. There is a modest, but well-executed title screen. Several games can be scheduled at identical times if enough playing locations are available. Schedules can be saved to disk and re-loaded. Error-trapping is extremely thorough.

League Organiser represents a major contribution to Atari software, and could easily have been a commercial release. Instead, it has been placed in the public domain. You can get your copy from Page6 Publishing, P.O. Box 54, Stafford, England, ST16 1DR. The cost in pounds Sterling is:

| | handling | postage | total |
|---|---|---|---|
| U.K. | 2.50 | --- | 2.50 |
| North America | 2.50 | 2.00 | 4.50 |

*[Editor's Note: as of November 1993, the exchange rate is about US$1.50 to the British pound. -BP]*

Adrian Hyland deserves a huge THANK YOU from the entire Atari Classic community for creating such a useful program. Fan letters can be sent to him at 29 Woodfield Ave., Gravesend, Kent, England, DA11 7QQ.

## More Challenges

1. When our team rep, Ernie, went to a league meeting and pointed out the inequities of our schedule, a few changes were made. Two or three teams were shuffled around so the late games were more fairly distributed. This would have been impossible to do with League Organiser. Of course, it may not have been necessary had League Organiser been used in the first place. Still, circumstances may arise where minor adjustments are necessary. The ideal program would allow for:

(a) a complete recalculation of the entire schedule, using a different sequence of team pairings;

(b) a partial recalculation, involving only certain teams.

2. Sometimes schedules are needed for situations where full round-robin play isn't possible. For example, if I were scheduling a weekend tournament for 10 teams, I couldn't use League Organiser, which would require a minimum of 45 games to be played. There just isn't enough time in a weekend for that many games. One solution is to divide the teams into pools for round-robin play, then have Coe winners meet. If there's a separate playing area for each pool, then each pool can have its own schedule. But if there's only one playing area (which is often the case), a single schedule must be produced without losing track of which pool each team belongs to. Also, since pools often have an odd number of teams, byes are sometimes necessary.

3. The printouts can be quite lengthy. A test schedule for my hockey league, whose season consists of 189 games played by 7 teams, came to 14 pages. This was twice the length of the actual schedule provided by the league.

4. Although the program can schedule two or more games at the same time in different locations, there is no way to identify these locations on the printout.

5. Once you know how the program works, you can produce a schedule in very short order. But even with the instructions handy, it took me a couple hours to acquire that knowledge. Mostly I learned by trial and error. The steep learning curve is caused by an accumulation of minor difficulties. Most commands require the use of two keys (or keypresses) when one would have sufficed. Both Spacebar and Return have important functions, but I found myself constantly hitting the wrong one.

Some "difficulties" were due to language, and may not be experienced by users in the U.K. For example, the word "fixture" is used in a way North Americans may not be familiar with. (It means "schedule".) I also had trouble with the phrase "playing area"; sometimes it seemed to mean a location and other times a time slot. "Time slot," by the way, is a bit of a misnomer, since the game only handles starting times; game duration is never a factor in producing a schedule.

Finally, it took a while to understand how to enter "weekly" game times. The program requires you to define a season for each day of the week, as required. It would be simpler to do it once, then enter all recurring game times.

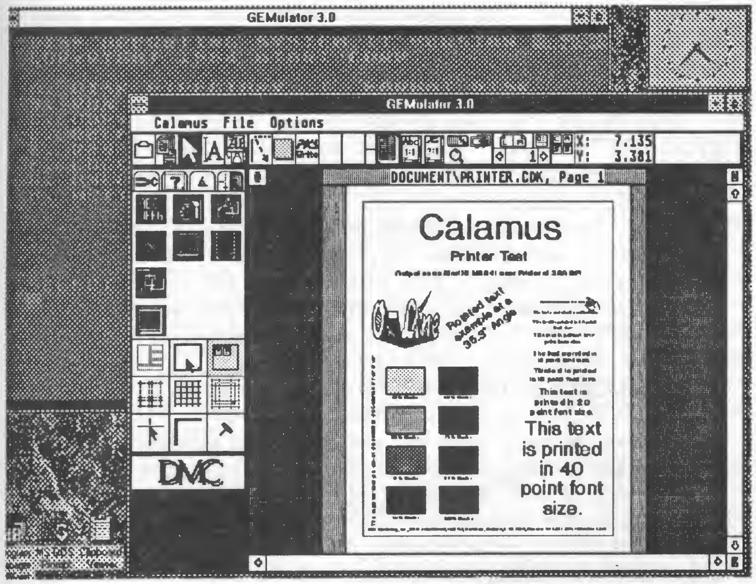
## Text Adventure Update

I recently obtained some issues of a well-done, but defunct British magazine called *Monitor*. In it appears Steve Hillen's four-part series on writing text adventures. It begins in issue 12 with a small but complete adventure game system in BASIC. Part 2 (issue 13) discusses data compression, and Part 3 (issue 13) provides a parser with several ML routines. The series concludes in issue 16 with a tutorial on split-screen displays. All-in-all, a useful series.

Recently, the Tyne & Wear Atari User Group in England began publishing a newsletter. In issue 4 (July/August 1993) there is a BASIC program called Word Weave. It's described as "a specialized word processor for creating branching text stream, be it interactive fiction or a host of practical multiple-path applications." The newsletter contains complete instructions, while the program is found on the accompanying disk. Apparently the program first appeared several years ago in a publication I'd never heard of before,*Home Computing Journal*.

Finally, ZORK LIVES! (Well, for IBM-compatibles at least.) In a recent issue of *Computer Gaming World*, I came across reference to a new game being released under the Infocom label. *Return to Zork*, however, bears little resemblance to the Zorks of old. It's a graphics-based RPG whose developers used professional actors performing against computer-generated backdrops. My, how the times have changed!

# Atari Emulation Comes To The PC: Xformer 3.0 and Gemulator 3.0




Windows 3.1 screen dump shows Gemulator running Atari XE DOS 2.5 and Calamus SL.

**Last year we released Gemulator, the Atari ST emulation card for MS-DOS, Windows, and OS/2. With the freedom to run Atari ST software on a PC just about anywhere, over 600 Atari users just like you are already using Gemulator on their PCs at home, at work, at school, and when they travel.**

**Gemulator turns a PC into an *awesome* ST clone:**

- **TOS 2.06 ROMs included,**
- **640x480 and 800x600 color graphics,**
- **1.44 meg floppy disk support,**
- **9600 baud modem and sound support,**
- **emulates up to 8 meg of ST RAM,**
- **ST Xformer Atari 800 emulator included,**

**are all standard features of Gemulator. No need to buy a Falcon or spend $$$ upgrading your ST!**

## *Gemulator 3 Is now available from Atari dealers including Toad, Rising Star, and PMC.*

***Highly Compatible Emulation***

***Inexpensive To Install***

***Reviewed***

**Gemulator is fully compatible with:** Pagestream, Calamus / Calamus SL, MultiTOS, Geneva, Silhouette, Pha$ar, LDW Power, Word Up, ST Writer, GFA Basic, Neodesk, Prism Paint, Flash, Tempus, Degas, Word Writer, First Word, Hotwire, Multidesk, Maxifile, GDOS/G+PLUS, Quick ST, Warp 9, Word Flair, EZ Calc, Sudden View, Laser C, ST Xformer, Magic Sac, Interlink, Avante Vector, Thunder, UIS III, Data Master, Turbo ST, NVDI, Extended Control Panel, Word Flair II, and hundreds of other Atari ST programs, utilities, and desk accessories.

Gemulator requires only a basic 386 or 486SX PC. Just price for yourself what it would cost to either upgrade your existing ST to TOS 2.06, VGA graphics, 1.44 meg floppy, and 8 meg of RAM, or what it would cost to buy the Falcon, and you'll see that Gemulator is a very sensible alternative to using an ST. Product reviews in Current Notes and ST Informer agree.

## *From the developer of the ST Xformer (Atari 800 and Atari 130XE) emulators...*

**Get ready for PC Xformer 3.0, the MS-DOS version of the popular ST Xformer Atari 8-bit emulator first released in 1987. People said they wanted it on the PC, and we thought it would be a great idea!**

**Unlike the original ST version, PC Xformer 3.0 runs several times faster than a real Atari XE, supports GTIA graphics and player missle graphics, and uses existing ST Xformer virtual disk files. So simply transfer your 8-bit software from the ST to the PC and run it faster and with better compatibility than ever before. Requires a 286/386/486 based PC, VGA card, and 1 meg of RAM.**

**New for 1994!**

**For a demo video, upgrade information, or more product information, write or fax to:**

***Branch Always Software,*** 14150 N.E. 20th Street, Suite 302, Bellevue, WA 98007
**Phone (before 2pm Eastern time) or FAX: 206-885-5893 CompuServe: 73657,2714 GEnie: BRASOFT Delphi: DAREKM**

# Tips 'N' Tricks

## 80-Column Switcher, Rev. 2

In the April '91 issue of *Current Notes* there appeared an article by The 8-Bit Alchemist titled "80-Column Switcher" describing how to build a switchbox so you can use the same video monitor with both your XEP80 and your computer's standard 40-column output. Immediately following the publicaton of that article, The Alchemist was deluged with requests from people asking him to "please build me one". None of those requests was ever satisfied.

But, you can build your own with readily available stuff from Radio Shack. For under $10, and you don't need any tools (bare hands will suffice). This is a guaranteed success for even the most ham-fisted technophobe. Purchase one each of #15-1247B (Mini A/B Video Switch) and three each of #278-255A (Male F-Connector to Female Phono Jack Adapter). Just screw the adapters onto the three threaded connectors on the switch, and you've got yourself a genuine 80-Column Switcher!

There are some screws and double-stick tape and stuff you can use to fasten the Switcher to the top or side of your monitor if you wish. Connect your monitor to the center jack, and your computer and XEP80 to the ones on either side. You might need short lengths of RCA phono cables for this. Radio Shack sells them. Most people end up with a few spare RCA cables from their stereo system. You might want to rummage in your spare audio cable box before running to the Rip-Off Shack for cables.

Setting up the Switcher is a little tricky. Horizontal sync on the XEP80 is a slightly higher frequency than on your 40-column output. So, if you adjust your monitor for a stable 80-column screen, you'll find the picture shearing badly when you switch to 40 columns. When you adjust for a stable 40-column display, it wll be out of adjustment when you switch back to 80 again. This will drive you nuts.

Use the M-test to fix it. Boot up your computer with the XEP80 and use either BASIC or an 80-column wordprocessor to fill the screen with capital M's. (The middle of the M is exactly one pixel so a screenful of these is nice for monitor adjustments, especially focus.) Leave the XEP80 on, turn off the computer, re-boot in 40 columns, and again fill the screen with capital M's. Adjust your monitor for a stable 40-column display and make any sort of convenient index mark to note the control setting. Then switch to 80 columns (the XEP80 will still display the test screen which stays stored in its onboard SRAM as long as power is applied). Adjust the monitor for a stble 80-column display and note how far from the 40-column setting you had to turn the control. Now reset the control to a point midway between the 40- and 80-column settings, and you should find a stable display in either position. The exact settings will vary from monitor to monitor, but in general you should be able to locate a central point on the horizontal control that will provide a stable display in either 40- or 80-column mode without having to re-twiddle the control each time you switch.

## Parts Sources

With the heavy emphasis on hardware hacks in this issue of *AC* it might be handy to pass on word of some parts sources that carry items of more general interest than the usual fare found in Atari-specific vendors such as CSS, Best, ATV or B&C. Or maybe you're just tired of running to the Rip-Off Shack, whatever. The following suppliers are mailorder sources for electronics parts, tools, and supplies. Contact these folks and be sure to get their catalogs before you try to order stuff.

**B.G. Micro** P.O. Box 280298, Dallas TX 75228 USA. 214-271-5546. VISA/MC. Excellent source for cheap DRAMs if you're doing a RAM upgrade. Would you believe a set of nine 150nS 256K DRAMs for $9.95? 1-megger DRAMs for $4.40 (not bad). How about a replacement 2793 for that aging 1050? They gottum, seven bucks. Replacement 6264 SRAMs for the XEP80, $1.40 (cheap!), and 32K SRAMs for the Black Box print buffer, five smackers (decent). And if you decide to build the SIO2PC (*AC*, Feb. '93), BG sells the MAX232 for a buck sixty-five. Nice mailing list to be on.

**JAMECO Electronics** 1355 Shoreway Road, Belmont CA 94002-4100 USA. Orders toll-free 800-831-4242. VISA/MC. A general source for a wide variety of general electronics parts, they sell everything required for any of the upgrades described in this issue of *AC*. Jameco publishes two separate catalogs: one for electronics parts and one for computers. You'll want both. In their computer catalog you'll have to wade through a ton of stuff for IBMs, but there are useful items in there such as rebuilt monochrome TTL monitors for under $100 or new ones for a little more. Also chips, DRAMs, soldering supplies, etc. Even a few items for the Apple 8-bits, Jameco is one of the last to support the old Apples.

**JDR Microdevices** 2233 Samaritan Drive, San Jose CA 95124 USA. Orders toll-free 800-538-5000. VISA/MC/Discover. Analogous to Jameco, slightly different stuff, a tad pricey. Also two separate catalogs for computers and parts, get both. Good selection and good service.

**Digi-Key Corp.** 701 Brooks Ave. South, P.O. Box 677, Thief River Falls MN 56701-0677. Orders toll-free 800-344-4539. VISA/MC. A hard-core supplier of parts, instruments, and supplies for your engineering-types, lots of interesting tekkie data on the parts they sell. Single-unit sales or bulk-lot OEM purchasing for big savings if you spend big bucks.

**Mouser Electronics** 2401 Highway 287 North, Mansfield TX 76063-4827 USA. Orders toll-free 800-346-6873. VISA/MC/AMEX/Diners/Discover/Carte Blanche. Another hard-core electronics part supplier, on the same order as Digi-Key. Faster delivery in the US/Mexico/Canada since they have several regional mailorder distribution centers. Active/passive electronic parts and supplies. These guys will even sell you a bench-mounted hand press for cutting/stamping your own custom sheet metal chassis if you're into that sort of thing.

# Color And The Clock

### by Ben Poehland, AC Managing Editor

## Old Ludwig

There's a colorful story about Ludwig van Beethoven in his later years when he was stone deaf and turned out his greatest masterpieces. He developed a habit of dousing himself with pitchers of water to cool down the heat generated by his creative labors. He ended up moving around town a lot, as this got him in no end of trouble with landlords. There came a day when an enraged landlord, dripping wet from old Ludwig's activities on the floor above, came barging into Beethoven's room to deliver the eviction—and instantly retreated in terror from a sight that assaulted his sanity. It was Beethoven: half naked in a filthy nightshirt, dried shaving cream all over his face and long cotton wicks dipped in smelly yellow liquid trailing from his ears, stamping and screaming and thumping on a stringless piano... .

Reminds me of The 8-Bit Alchemist. You wouldn't believe that guy. He opens up a computer, and in short order the whole house is trashed. He stomps all over the place muttering nonsense about Murphy Demons and spends hours in an upstairs room wreathed in a pall of solder resin fumes. He'll drop some small part on the floor, and oh! such swearing! The worst came when he was trying to install Super Video in a 600XL. It seems this particular 600XL (which began its existence as the property of one John Nagy, now of *AtariUser* fame), was defective before The Alchemist began modifying it.

## Alchemist Vs. Corollary No. 6

Now the poor fellow was going bonkers trying to figure out why the modification, which worked so well in other XLs, didn't work in the 600XL. Such cussing was never heard from a dozen sailors! I retreated to *AC*s Editorial Offices to escape The Alchemist's wrath, to no avail. The old goat followed me in there, still foaming over the recalcitrant 600XL. He drew up before a glassed-in frame on the wall holding a poster that reads:

**MURPHY'S LAW: IF ANYTHING CAN GO WRONG, IT WILL.**

There follows a list of 10 items elaborating Murphy's Law, under the heading:

**COROLLARIES:.**

The Alchemist studied the list for a moment, then excitedly jabbed a bony finger at the poster with such force I feared he would break the glass (it happened once). "There!" he shouted. "Number Six, it got me again! Confound Murphy and all his dirty tricks, the devil take him...". There followed a nonstop 10-minute stream of verbal vitriol lambasting Murphy, Atari, James Morgan, all people named "Tramiel", and the Sunnyvale Butchers, at the end of which The Alchemist slumped into a chair completely spent, a trickle of slobber dripping from his chin.

I gingerly glanced at the poster to read which Corollary he was talking about:

**6. WHENEVER YOU SET OUT TO DO SOMETHING, SOMETHING ELSE MUST BE DONE FIRST.**

"So", says I, "by this I take it you mean the 600XL must be repaired before you can proceed with the modification? Well gee, that's not so bad."

He bolted up, eyes flashing. "Not so bad? NOT SO BAD?? Good heavens! How am I to know if the problem is in the mod or elsewhere? No, no! The only way is to strip it all out, put back all the original parts, repair it, then start all over again! So much good work, all wasted and frittered away on this [ADJECTIVE DELETED] piece of junk! Oh, woe is me, I'll *never* finish this thing!" he groaned as he sagged wearily back down in his chair.

He looked so pitiful there, all bedraggled and defeated. I saw in this an opportunity for the restoration of domestic tranquility, and I knew what to do. "Lookit here old fellow, you've hit a rough patch, you're all done in. You need a little rest, then you'll be fit again. And hey, while you're recharging your batteries I'll look over the machine and repair it for you. You've got a good video signal, it's just the color that's poopy. Heck, I can fix that! When you come back you can continue Super Video right where you left off."

He gave me a heartrending look as he shuffled out of the room, like a lost puppy just returned to its owner. "You would do that for me? Bless you, dear boy! I guess I *am* a little used up, I could use a rest. When I come back I'll finish Super Video. It'll work great, you'll see! I can do it, really. I just need a good machine, that's all. Then I'll put Super Video in the 1200XL, and... and... ...".

## Funky Color

Man, I thought I'd *never* get rid of the old geezer. In his absence I gave the funky 600XL a good going-over with a nice Commodore 1902 color monitor attached. The picture was clear, but color was runny and kept flipping between puny color and mono. I looked over Jeff Potter's article on adjusting the color potentiometer and tried twiddling the color pot. Bad move. "Something" happened, after which the screen stayed monochrome no matter how much I twiddled either the computer or the monitor. Peachy. I'd gone from runny color to none at all. Having just promised that crazy old man I'd have his machine ready to go when he came back, the first faint twinges of anxiety began creeping up my spine.

I called Jeff McWilliams, from whom I'd purchased the machine (this computer definitely had a checkered history), and described the problem. "Oh yeah", he says, "come to think of it, that thing always had lousy color. Weak and runny, and sometimes it went mono. It was like that when I got it from Nagy. I just figured it was because of the interface. I was using it with a TV, which is pretty cruddy to begin with. I mean, if the video is malfunctioning intermittently, but your interface is junk, how can you tell where the problem is?" I couldn't argue with Jeff's logic, but this was a rotten time to find out about it.

I did all the normal, sensible things. You know, chip-swapping: GTIA, ANTIC, 4050 video buffer, CPU, OS ROM. Zilch, the screen was still as gray as Mosby's ghost. I carefully double-checked all the parts The Alchemist had stuffed in there as part of his Super Video upgrade. No problems. (The Alchemist might be a maniac, but I must say the man does beautiful work.) It was time to fire up the oscilloscope.

## Homing In On GTIA

A 'scope check of the GTIA showed no color signals coming

out on pins 21 and 25, which explained why replacing the 4050 had no effect. It also cleared The Alchemist of any wrongdoing, since the problem originated upstream of the color amplifier components he installed. I monitored pin 17 of the GTIA and twiddled the color adjust pot some more. As I ran the pot through the extremes of its travel, the voltage rose from zero to about 0.2V and stayed there. I checked pin 17 GTIA voltage on a healthy 800XL exhibiting a nice blue BASIC screen, and found 4.8V. Aha! Obviously the GTIA in the bad 600XL had a defective input stage that was drawing too much current and loading down the pot voltage. It *had* to be the GTIA!

I replaced the GTIA again. Darn, no voltage and no color! Out of the corner of my eye, I *swear* I saw a small green scaly thing with webbed claws skitter across the floor, accompanied by a high-pitched cackle. Was it my imagination? Or was there *really* such a thing as a Murphy Demon, born enemy and sworn foe of my Alchemist friend? My mind wandered... I recalled a strange statement The Alchemist once had made, about doing battle with unseen foes in total darkness, and how gratifying it was when he actually managed to skewer one of the nasty buggers upon the point of a hot soldering iron. He kept the slain creature preserved in formaldehyde in a pickle jar but never let me see it.

I snapped out of my reverie, shrugged off these silly thoughts, and proceeded with my tests. OK, maybe the laws of Chance had conspired against me, and I had *two* bad GTIAs in a row. Well I got me a whole drawerfull of GTIAs and prepared myself to go through every single one until I found a good one. And so I did—3, 4, 5 GTIAs—and still no color. Man, this was really pushing the laws of Chance! Well, actually I *was* pushing the laws of Chance, but not in the usual statistical sense.

## Chance Favors The Prepared Mind

It was while testing GTIA #5 that a totally meaningless, random event occurred which finally put me on the right track. Check out Figure 8 in The 8-Bit Alchemist's "Super Video 2.1XL" article: you'll notice that just to the left of the 600XL video circuits is some additional circuitry (two transistors and a crystal, etc.) which comprises the system clock. I accidentally touched some of those clock components with a probe (or was it a finger?) and was amazed to see color briefly restored to the screen! OK, it was terrible color, runny and phasey and messy. But hey, this was progress, I was back up to the same crummy color I started with!

It made no sense. I mean, how could it be that messing with the system clock would generate a color signal at the video output? Well, it turns out the clock signal has everything to do with color. And it also turned out that my touching the clock circuit and observing an effect on my color display weren't necessarily connected events. Any high-frequency RF signal will behave unpredictably outside the controlled environment in which it was designed to function. Perhaps my instrument, or my body capacitance, coupled the clock signal to the video output, causing the monitor's chroma detector to trigger on the weak, unstable signal. Explain it any way you want, it's irrelevant. The real value of the experience was that it motivated me to sit down and seriously study the clock circuits.

Since the clock governs virtually all the major digital functions of the machine, following the clock signals amounts to a whirlwind tour of all the hardware. Not just in the 600XL, but in all the Classic Ataris: they all employ a clock generator, Atari custom LSI chipset, and color adjust circuit. For me it was like following a rainbow, with the prize being the discovery of the failed components in the color circuit instead of a pot of gold. (I don't need gold anyhow, The Alchemist makes all I want from lead.) Along the way I discovered some really neat stuff about how all the 8-bits work.

## Crystals and Clocks

In all the Classic Ataris the action begins with the crystal: 3.58MHz in the North American NTSC systems. Associated with the crystal is a two-transistor differential pair that buffers the 3.58MHz signal and passes it along as a low-level sinewave to pin 28 (Oscillator input) of the GTIA chip. The diagram in Fig. 1 is for the 800XL, but the oscillator circuit is identical in all the XLs.

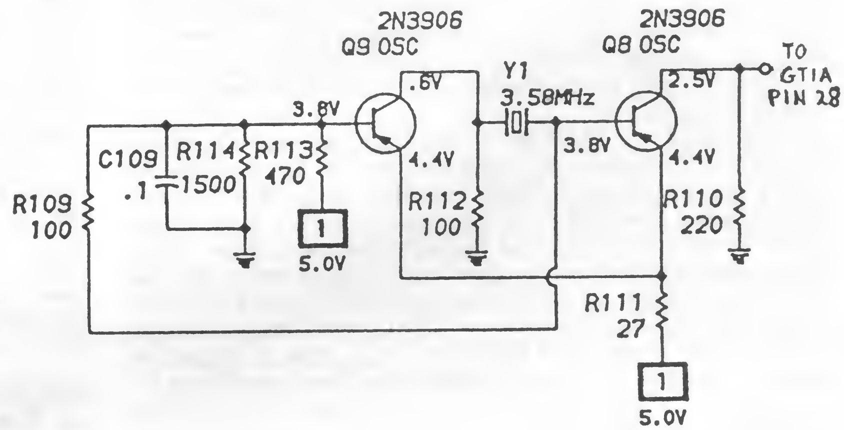
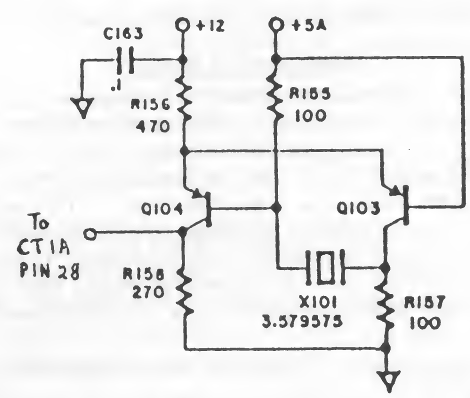



**Figure 1. Production XL clock oscillator.**

A slightly modified version of this circuit (Fig. 2) is used in the 400 and 800, as those machines employ an additional +12 volt bus. One half of the differential pair is powered by the +12V bus, while the other half runs off the +5V line. The availability of two different supply voltages simplified the design:

**Figure 2. 400/800 clock oscillator.**




The oscillators of Figures 1 and 2 are entirely absent in North American XE computers. Instead, a special IC oscillator feeds 14.3MHz to pin 2 of the FREDDIE chip which divides it by 4 and sends out the 3.58MHz to GTIA on pin 37. The 1450XL uses this arrangement as well.

## Follow That Clock!

GTIA (CTIA in the 400/800) amplifies the clock signal on pin 28 and snaps it up from a sloppy sinewave to a TTL-level squarewave, then puts it out again on pin 29 (Fast phase 0) which goes to ANTIC pin 35. ANTIC divides the 3.58MHz clock by 2, to 1.79MHz, and sends it back out again on pin 34 (Phase 0 clock) where it appears as an input on pin 37 of the 6502CPU after buffering by a 74LS08 gate (gate buffering varies in different models, and early versions of the 800 route the clock differently). The CPU re-phases the clock again and puts it out on pins 3 and 39 as the 1.79MHz Phase 1 and Phase 2 clock signals, respectively. (At this point hardware comparisons between the 400/800 and XL/XE end, as the Phase 1 and Phase 2 clocks in the 400/800 aren't used.)

The Phase 2 clock in various convoluted forms is basically the master clock signal for all the computer's digital functions. It controls timed events such as memory refresh, video synchronization, CPU instruction execution, I/O data fetching, and a zillion other things.

## Color and The Clock

What about that Phase 1 clock, what becomes of that? It doesn't live long once it leaves the CPU. From pin 3 of the 6502 it goes to the input of the color adjust circuit, where it gets clobbered. Or, to be precise, it gets rectified into a DC voltage that's applied to pin 17 of the GTIA via the color adjust potentiometer. In a healthy 8-bit computer the approximate voltage range of the color adjust pot and corresponding screen colors are as follows:

0.0 to 3.4 volts..... Monochrome
3.4 to 4.2 volts..... Green
4.2 to 6.7 volts..... Blue
6.7 to 8.0 volts..... Violet
8.0 to 9.1 volts..... Magenta/pink

The GTIA voltage:color relationship varies from chip to chip, which is why the color pot always needs to be readjusted after you replace a bad GTIA.

Okay, I hear you snickering. You know your computer runs on +5 volts, so where is this 8- and 9-volt stuff coming from? The diagram of Fig. 3 is the color adjust circuit for a 130XE, but the circuit is identical for the 600XL, 800XL, 1200XL, and 65XE.

The transistor isolates the clock signal from the violent events to follow: the little pulses go merrily to the slaughter with no inkling of what's to come. The diode connected to +5V (CR2) adds a 4.4V DC bias to fatten up the clock pulses for the killing, and the second diode (CR3) does the dirty work by rectifying the whole mess to about 10 volts DC. The resistor and two capacitors (C45-R37-C47) form a pi-filter that smoothes the DC and passes it (with some voltage loss) to the color adjust pot, from whence it goes to GTIA pin 17. This pin 17 bias voltage is really critical, as the GTIA seems to use it as an external reference for correctly phasing the color video signal fed to the input of the color video amplifier from pin 21.

The circuit of Fig. 3 is absent in the 400, 800, and 1450-XL. Those computers all have a +12 volt bus, so Atari just tied the color adjust pot to the +12V line via an isolation resistor. The Fig. 3 circuit was only needed in the machines that ran on a single +5 volt bus.

## Pink Is For BASIC

With these lessons fresh in mind I returned to the funky 600XL. GTIA #5 still wasn't producing any color, and I decided it just wasn't believable that I had five bad GTIA's in a row. To prove to myself the GTIA wasn't defective, I removed it and checked the DC voltage at pin 17 of the empty socket: it was still 0.2V. If the GTIA had had a shorted input on that pin as I erroneously thought, the voltage on the empty socket pin should have jumped up to about +9V, as I had the pot turned up full blast. What this told me was that I needed to look further upstream for the trouble.

I scoped pin 3 of the 6502 to see if the Phase 1 clock was there. Well, yah, it was there all right, but the little pulses looked *very* unhappy. Kinda skewed and smeary, like they had gotten wind of the fate in store for them and were trying to run away. Something in the color adjust circuit was giving away the bad news.

I moved my scope probe to the collector (marked "c" in Fig. 3) of the transistor, expecting to see the clock signal. All I saw was noise. So! It was the transistor. I removed it and checked it on my click tester: dead as a doornail. I stuck in a new transistor and fired up the 600XL.

No color. From somewhere, faintly, came a high-pitched cackle. I wasn't imagining it this time. Musta been a mouse, I've had a problem with mice in the kitchen lately. I kept my cool and scoped the collector of the new transistor. There was a nice healthy clock signal there, just waiting to be creamed. I moved along to the junction of the two diodes: the signal was healthier still. I jumped to the other side of the rectifier diode CR3, and... nothing. All those eager electrons were just left dangling in mid-air. I pulled the diode out and checked it on an ohmmeter: it didn't conduct in either direction (diodes should conduct in one direction but not conduct when the polarity is reversed). Not only was the transistor bad, but so was the diode.

As I replaced this diode with a good one, I again heard a strange noise, a howl or moan, as if something in the distance was dying. I looked out the window to check my neighbor's dog, but Old Bones was cheerfully chewing the remains of some odd critter he'd just found in the yard and didn't seem distressed at all. Annoyed by the interruption, I returned to the 600XL and fired it up.

I got a big pink screen. PINK??? Doofus me, I'd left the color pot cranked all the way up. I tweaked it down till I got the usual blue BASIC screen, then fine-tuned it with Jeff Potter's nifty color adjust program. I stood back to admire my handiwork and was seized by a sudden impulse: a loud war-whoop inexplicably escaped my lips.

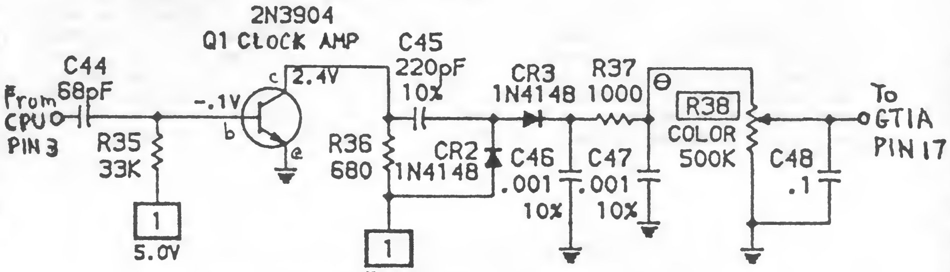



**Figure 3. XL/XE color adjust circuit.**

## Old Goat Returns

Big mistake, I awakened The Alchemist. There was a huge ruckus, and suddenly he appeared with shirttails all a-flutter and wearing mismatched socks (one blue, one brown). I could see

he was in high feather: he had that wild gleam in his eye and brandished a smoking soldering iron like some kind of weapon. He brushed me aside without a word and went immediately to work, firing up a pile of color monitors on the kitchen table and studying the results of his Super Video modification. Soon the muttering began, then the familiar stream of curses.

Somewhat miffed, I went slinking upstairs to my Editor's lair in the *AC* office. But I couldn't think with all that noise going on. The racket down below swelled to a roar that shook the house, as if some terrible battle between cataclysmic forces of Nature were being fought. Once, I thought I heard that high-pitched cackle, followed at once by a piercing shriek that ended abruptly amid bloodcurdling screams from The Alchemist: "Take that, you devil! Now I've got you, I'll have all of you! I'll rip your flesh and crush your bones, you'll not escape me! Give it up, give it up!" I couldn't bring myself to gaze upon whatever nightmare was going on down there. It was madness.

I closed the door to the office, achieving peace at last. I leaned back in my comfortable Editor's Chair and closed my eyes. I was still feeling rather hurt. Really, I would have thought the guy could at least thank me for repairing his machine. What a bum he is, I keep trying to kick him out. But then he gives me that wounded-puppy look (I *know* he's manipulating me), and I go all soft and take him back again. Sheesh, now I'm way behind on my editing, and I fear this issue of *AC* will be late.

# A Multiscan Monitor For The Classic Atari

## by Larry P. White, AC Contributing Author

| | | |
|---|---|---|
| CRT | | 13" Viewable<br>90 degree deflection<br>0,31 mm trio dot pitch<br>Tinted glass, Non-glare<br>P22, Medium-short persistence |
| Input Signal | | |
| | Comp. video | NTSC |
| | RGB video | TTL Positive 8/16/64 Colors<br>Analog 0.6 Vp-p positive |
| | Sync. | Separate sync. TTL ±HD, ±VD<br>Comp. sync. TTL ±HD/VD<br>Comp. sync. on green video |
| Connector | | BNC Jack<br>D-Sub 9-pin<br>D-Sub 25-pin |
| Synchronization | | |
| | Horizontal | 15,6 KHz to 36 KHz (Automatically) |
| | Vertical | 45 Hz to 90 Hz (Automatically) |
| Resolution | | RGB TTL/ANALOG — Comp. Video |
| | Horizontal | 800 dots — 500 TV lines |
| | Vertical | 560 lines — 350 TV lines |
| Display Area | | |
| | Horizontal | 245 mm (It is possible to |
| | Vertical | 184 mm size control) |
| Video Band Width | | 30 MHz |
| Misconvergence | | Less than 0,4 mm (Centre) |
| Power Supply | | 120 V, 60 Hz |
| Power Consumption | | 85 W |
| Dimensions | | 362 (W) x 328 (H) x 383 (D) mm |
| Weight | | 14.5 kg |
| Controls | Front | Contrast<br>Brightness<br>Power switch |
| | Back | Input signal switch<br>Scan mode switch<br>V-Scan mode switch<br>TTL color select switch<br>Color saturation<br>Tint<br>Horizontal position<br>Vertical position<br>Horizontal size<br>Vertical size |

**Figure 2. Performance specifications of the AUM-1381A (from the Mitsubishi operator's manual).**

### 80-Column Blues

First off, I have to warn you: his is not a "how-to-do-it" article. This is an article about my use of my Atari 8-bit and XEP80 with my particular monitor. You could damage both your XEP80 and your video equipment if you connect things improperly. Don't try this stuff unless you fully understand this article and have also read the related articles in this issue of *AC*.

When Atari announced the XEP80 back in 1987, I was overjoyed to hear that Sunnyvale at long last was providing 80-column capability for the 8-bit. I purchased the XEP80, then waited for something to use with it. When Atariwriter-80 was finally released in 1989, I connected my XEP80 to my color composite monitor only to discover that it couldn't display 80 columns of text due to overscanning (see Bob Woolley's discussion of this problem in his "TTL Video for the Classic Atari" elsewhere in this issue). In addition, the text was illegible, which I guess was to be expected on a color monitor. Over the years I have seen a few composite color monitors that could produce reasonably legible text in 80 columns. Unfortunately, mine wasn't one of them! I also tried another (allegedly) 80-column composite monitor which produced legible text, but again overscanned the screen. I put the XEP80 in the closet. I waited all these years for this? Rats!

### The Woolley Connection

Some time later, I came across an intriguing file titled "XEPIBM" by Bob Woolley in the SYSTEM UTILITIES section of CompuServe. After downloading, this looked like just the ticket for the XEP80! *[Editor's Note: this file is an earlier version of Bob's TTL conversion article presented in this issue of AC. The version presented in this magazine is improved. - BP]* By that time I had acquired a Mitsubishi Diamond Scan AUM-1381A multiscanning monitor. This is a true multiscanning monitor that has the ability to synchronize itself to a variety of incoming horizontal signal frequencies from the standard 15.75KHz of color TV all the way up to the 36KHz required by VGA. Figure 1 (from the Mitsubishi manual) shows all the inputs available on the rear of the unit.

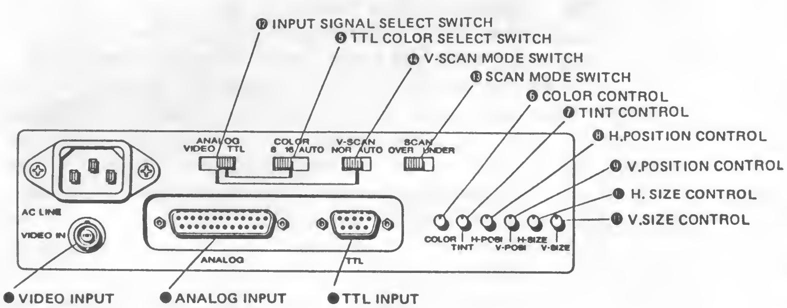



**Figure 1. Rear panel connections on the Mitsubishi Diamond Scan AUM-1381A multiscan video monitor.**

I had already tried hooking the XEP80 to the composite (color) input, but this had produced unacceptable results. Would Bob's clever adaptation work?

Looking at the "Operation Manual" for my monitor, I noticed the digital (TTL) input would handle either CGA (16 colors), EGA (Enhanced Graphics Adapter, 64 colors), or MDA (TTL monochrome). The manual also had detailed pinouts for all the input connectors as well as a thorough description of the unit's performance specifications (shown in Fig. 2).

### XEP80 To Multiscan

Adapting the XEP80 to my monitor posed minimal problems. However, Bob Woolley's modification instructions had to be translated for the input on the multiscanning

monitor, which requires knowing what the pin descriptions actually mean. Also, there weren't any specifications available to me detailing the output signals and characteristic of the XEP80. Since the inputs on various multiscanning monitors are quite likely to be different, it's not possible to provide detailed information. Some interpretation is required, which is definitely more complicated than simply following a set of mod instructions. Still, the only real problem I encountered was minor difficulty making the solder connections to the bottom of the circuit board in the XEP80, as there was very little of the pins protruding through the board.

After completing the XEP80 TTL mods and connection to the TTL input on the AUM-1381A, I booted up AtariWriter-80. The full 80 columns was visible, but it completely filled the screen, border-to-border with the monitor display size turned as low as possible! I only hooked up the green input on the monitor, so essentially it is an 80 column "green-screen" display. The characters are very clear and crFip. They are tall and thin, typically 5 pixels wide by 8 pixels high in a 7x10 cell. The text looks very much like composite monochrome.

Having 80 columns definitely provides additional value for the 8-bit, but the difficulty in finding a suitable monitor shouldn't be discounted. In my setup, the size control is turned as low as possible in order to get all 80 columns on the screen (barely)! In the documentation for my XEP80, it lists the firmware as "Rev. 41.1" and the XE Handler as "Rev. 70.0". Those numbers suggest that a chronicle on the development of the XEP80 would make an interesting. Anybody?

To the best of my knowledge, AtariWriter-80 was the only software Atari ever released for the unit, and it came two years after the hardware. Having an 80-column wordprocessor is a decided advantage. Although AtariWriter-80 does have its quirks (which have been pretty well catalogued in the pages of *AC*), it works reasonably well.

## One Size Fits All

I originally bought a multiscanning monitor so I could connect my 1040ST and 130XE to a single monitor, since monitors consume lots of desk space. With its wide variety of inputs, the AUM-1381A is extremely versatile. Unfortunately, like nearly all PC-type monitors, it doesn't support sound, so the audio output of my Atari is connected to a small Radio Shack amplifier/speaker. With the popularity of sound boards for PC's, small amplified speakers are abundant. Many of these produce very good sound quality.

The AUM-1381A's composite input is a "BNC" connector, so an RCA-to-BNC adaptor (from Radio Shack) is required for the typical video connectors. The analog VGA (Video Graphics Array) input is a DB-25 connector, and the TTL input is the industry-standard DB-9 type. The unit has a full complement of user-adjustable controls to properly size and center the picture. The only drawback is that only the power switch, brightness, and contrast controls are front-mounted. All other controls and switches are on the rear panel.

The Mitsubishi's analog input worked perfectly with my ST's color (medium resolution) output. I had intended to install a switchbox and use the high resolution output of the ST but never got around to actually hooking it up.

Currently, my 130XE's 40-column output connects to the AUM-1381A's composite input, the XEP80 to the digital, and my home-assembled 386 clone goes to the Diamond Scan's VGA connector. As can be seen in the accompanying photograph (Fig. 3), the system still takes up a lot of desk space, but far less than if two monitors were used! I am and always will be an Atarian, but I just can't ignore the raw

**Figure 3. Classic Atari 130XE 8-bit (right) happily shares multiscan monitor with 386 VGA system (left). Note stack of 8-bit peripherals under the lamp (XEP80, XF551 and 1050 drives, etc.).**

power of the PC both in terms of hardware and software. The range and sophistication of software is truly impressive! The only game I play on the PC is Golf, and you have to see 640x480 resolution, 256-color Golf to believe it: it's that good!

Still, for most games, hacking, and just plain fun, you just can't beat the classic Atari 8-bit! If you've seen any of the machine-language games from Europe recently, you'll agree they're generally more impressive than most anything released in the USA during the 80's. Programmers have continued to "push the envelope" on the 8-bit. So my trusty Atari still sees plenty of action. I frequently have both machines running and switch back and forth between them. And the Diamond Scan, it's absolutely great! A beautiful display and excellent flexibility!

## Big Bucks Beastie

The Mitsubishi AUM-1381A multiscanning I purchased several years ago has been replaced by a newer model, the AUM-1391A. I haven't seen the newer model, but I'm told it's very similar to the 1381A and has an improved CRT using a smaller dot pitch for better color resolution (dot pitch on the AUM-1381A is .31mm). According to a Mitsubishi sales representative, the new AUM-1391A still accepts the same variety of VGA, digital, and composite inputs.

The Diamond Scan monitors are now distributed through Mitsubishi's Professional Electronics Group, which you can contact by calling toll-free 1-800-733-8439 for info on dealers in your area. Checking local vendor prices, I found the cost ranged from $515 to $620 excluding shipping. The $515 price is pretty consistent with the $469 I paid several years ago.

You're probably gasping at these prices. No doubt about it, multi-sync monitors are the most expensive type of monitor on the market. Is it the only option? I didn't make an investigation of monitors capable of this type of hookup, but I'm aware of at least one that accepts multiple inputs (see Ben Poehland's article "Super Video 2.1XL" for info on the Magnavox 1CM135). The most important thing to watch for when you're monitor-shopping is to ensure the unit you're considering will work properly with the signals from the source units you intend to use it with. And of course, you the user must be satisfied with the quality of resulting display!

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